MARINE REVIEW

Entered at Cleveland Post Office as Second-class Mail Matter.

VOL. XXIV. Published every Thursday at 418-19 Perry-Payne Bldg., by the Marine Review Pub. Co. CLEVELAND, O., SEPT. 19, 1901. Subscription $3.00 a year. Foreign $4.50 a year. No. 12

WILLIAM McKINLEY.

The cheerful and optimistic view which the country took early last week of the president's condition was suddenly changed to one of deepest apprehension. The notification came swiftly, and almost before the country could inure itself with fortitude for the worst, the most popular president in the nation's history had passed away. His death was signally poignant in that everyone felt as though a member of his own family had departed—such, indeed, was the sense of personal relation which the president bore to the community. No one, not even Lincoln, came closer to the people. It is difficult to judge of the qualities of such a man, for love is so prone to magnify. The man had so winning, winsome and charming a personality that he disarmed opposition at the start. It was absolutely impossible for McKinley to wantonly injure a single living thing. He dreaded conflict. Conciliation was the chief and essential attribute of him. It is extraordinary that a man with such sensitive nature, with such fine balance of justice, should have risen so high. The greatly successful are usually those who are lacking in these qualities. It would seem as though McKinley's very temperament would have stood in his way; but it was through the possession of those very qualities that he won success. He was not a leader; he was not, in the sense in which the word is commonly applied, a ruler. The president of the United States is not a ruler. He is an executive officer. McKinley was an executive officer of the highest type. He never sought to lead but simply to interpret. No man ever studied more diligently to ascertain what the people wanted and to give them what they wanted when he found it out. He was forever feeling the pulse of the people and his public utterances were merely the interpretations of that pulse as he translated it. Sometimes he erred; but no man more readily acknowledged an error than McKinley. We believe that in this quality, which was a part of the president's temperament, lies the explanation for those occasional changes of policy which marked his presidential career. He merely felt that he had formulated something which the people did not want and he changed it. He had no false pride about the matter—no dogged determination to crowd down the throats of the people any medicine which he had prescribed. He would change the prescription instantly if he felt that the national symptoms indicated some other form of treatment. He was, par excellence, a chief executive officer—and that only. He could never have played the role of dictator or tyrant. Tyranny of whatever character was repugnant to his nature. The wretch that shot him down lost the best friend he ever had; and it is not conceivable that the nation will have another like him in a cycle of time.

McKinley was the safest man that could possibly have been elected to the presidential office. Probably without exception he was the most self-possessed man living. This attribute of coolness was carried to its utmost reaches. He could not be lifted off his feet. Nothing could startle him. Presence of mind was always foremost. He would meet a whirlwind of men, torn with conflicting emotions, with the utmost calmness. Even when he was the center of the storm he was the coolest one present. Such a man could not commit a rash act. It is doubtless true that even when he was shot he was the only one present who completely kept his senses and his patience. It is said of him that while he momentarily held the assassin's hand after the shots were fired he looked at him calmly and steadily—not with anger and resentment but with compassion and pity. "Don't hurt the boy," he said.

The president was not a brilliant man, but he was a wise man—indeed, one of the wisest. He had spent a life of action among men and he knew human nature to its roots. He could handle all classes and conditions of men better than anyone else. It was common report in Washington that no one could go to the white house and leave it an opponent of the president's policy. This embraced the most rebellious of senators. They bowed to the wisdom of the president.

We cannot realize that he has gone—the kindly, gentle, thoughtful soul, who, if he had met a daisy in a footpath in the fields, would have stepped aside rather than crush it. Is it not an intimation of immortality that we cannot comprehend that we will never see him again—the common longing and the saving clause that binds mankind together under the great light of hope. And the manner of his death! How beautiful it was! Was it not an example of what a Christian death should be? He went into the great beyond with a blessing on his lips and with a resignation that was absolutely sublime. In the last few moments of his life he placed the unimpeachable seal of sincerity upon his long and useful career.

Mr. J. C. Ricketson, who was best known in vessel circles on the great lakes as the manager, some time ago, of the Inter-Ocean Transportation Co.'s vessels, died at his home in that city on Saturday last. He was seventy-one years old.

LAKE SHIP YARD MATTERS.

It is now more than probable that the Craig Ship Building Co. of Toledo and the Jenks Ship Building Co. of Port Huron, the two lake concerns building steel vessels independent of the American Ship Building Co., will soon have under way, alike to the big concern, all the new work they can possibly handle until next spring. The Craig company is completing two steamers of Canadian canal dimensions for Atlantic fruit trade and has arrangements practically completed for two ships—one a large lake freighter, referred to some time ago, and the other a steamer of something more than 200 ft. keel for Pacific coast parties. Officials of the Jenks company have not been altogether satisfied with their surroundings in Port Huron, and have talked of moving their plant to some other point, but whatever may be done on this score it is understood they have arranged plans and have the material for a vessel suited to salt-water service, in addition to the large lake freighter on which they are still at work for a company made up by the Minch family of Cleveland. This latter steamer will be sailed by Capt. Joseph Lampoh, who has been in the Onoko. Capt. W. H. Johnson of the Philip Minch has been appointed to succeed Capt. Lampoh in the Onoko.

Officials of the Detroit Ship Building Co. expect to turn over the 5,000-ton steel steamer Yosemite to her owners today (Thursday), and they are just a little proud of the record they have made in installing the machinery of this vessel and attending to her fit-out. It is expected that she will be loaded with coal within two weeks of the date of launching. She was launched Saturday, the 7th inst., and by the following Saturday, the 14th, engines, boilers, etc., had been placed aboard and everything connected up, ready for a dock trial. An error was made in saying that Mr. Alexander McVittie will manage this ship. She will be managed by Mr. M. E. Farr of Detroit.

One of the two steamers that are building at the Cleveland works of the American Ship Building Co. for transatlantic service, and which are to be of 7,000 tons capacity each on ocean draught, was launched on Saturday last and named Minnetonka. It is expected that the Minnetonka will be taken down to the seaboard in two parts before the close of canal navigation, but the second ship will not go down until next spring. The Minnetonka was christened by Miss Marion Wetmore, daughter of Mr. R. C. Wetmore, secretary of the ship building company. Chas. E. & W. F. Peck, insurance brokers of New York, represent the principal stockholders in the American Navigation Co., which is to own and operate these ships.

The Detroit Ship Building Co. is building four new boilers for the Michigan Central car ferry Transport. They will be placed in the boat during the winter. The boilers now in the boat have been in service for twenty-two years.

Arrangements are being made at the Buffalo works of the American Ship Building Co. to launch on the 28th inst. the large package freight steamer under construction there for the Western Transit Co.

THE AMALGAMATION LOSES THE STRIKE.

The strike of the Amalgamated Association against the United States Steel Corporation has resulted in a complete victory for the Steel Corporation. The men are returning to work and the plants which have been idle are resuming operations as fast as fires can be lighted in them. It is announced that practically all the idle mills of the great corporation will be running before the end of this week. Several of the mills of the American Sheet Steel Co., American Tin Plate Co. and the American Steel Hoop Co. have already started. It is understood that the refusal of the Joliet, South Chicago and Milwaukee men to continue the strike lost for the Amalgamated Association more than 10,000 men. This labor organization never received such a set-back since its formation and the belief is general that the outcome will be its dissolution. It is estimated that between 75,000 and 80,000 men were out during the strike. An official of the Steel Corporation has made the following statement:

"It is true that neither the Federal Steel Co. nor National Tube Co. was represented at the meeting held in the Battery park building last Saturday. The men employed in the mills of these companies who went out did so in sympathy with the American Tin Plate, Sheet Steel and other companies directly affected. We had nothing to settle with them, and now that President Shaffer has declared the strike off all they have to do is to return to work. As to future prices of iron and steel I believe there will be no immediate change, although independent iron and steel companies that have taken advantage of the strike by advancing prices will undoubtedly have to come down to the level fixed by the United States Steel Corporation. The fact that it will require months for us to fill the orders already on our books, thereby making it necessary for the various companies to reject new business, convinces me that readjustment of prices is very remote. The strike has resulted in a complete victory for the Steel Corporation, although in our dealings with the Amalgamated Association we did not overstep the demands of right and justice."

The new Morgan line steamship El Dia has just arrived at New York from the works of the Newport News Co., her builders. She will sail between New York and New Orleans. The El Dia, which is an improved type of the fast cruiser Buffalo (formerly El Cid), is a steel vessel having two pole masts and a single smokestack. She is 406 ft. long, 48 ft. beam and 33 ft. 9 in. deep, and is 4,608 tons gross and 2,905 tons net. She is fitted with vertical triple-expansion engines, and is lighted throughout with electricity, including running and searchlights. She is commanded by Capt. Quick, commodore of the Morgan line fleet.

Capt. James Barry, well-known tugman and harbor master of Chicago, died at his home in that city on Friday last.

SUMMARY OF NAVAL CONSTRUCTION.

The monthly summary of naval construction, issued by the bureau of construction and repair, shows a fair degree of progress. Nearly all of the builders have begun work upon the contracts for battleships and cruisers lately awarded to them. The Bath Iron Works will launch on Sept. 28 the cruiser Cleveland, which is given as 64 per cent. completed. Following is the summary:

Name.	Building at	Degree of completion, Per cent. Aug. 1.	Sept. 1.
BATTLESHIPS.			
Illinois	Newport News	98	99
Maine	Cramp & Sons	58	64
Missouri	Newport News	42	44.69
Ohio	Union Iron Works	43	43
Virginia	Newport News	0	0
Nebraska	Moran Bros. Co.	0	0
Georgia	Bath Iron Works	0	1
New Jersey	Fore River Co.	0	0
Rhode Island	Fore River Co.	0	0
ARMORED CRUISERS.			
Pennsylvania	Cramp & Sons	0	2
West Virginia	Newport News	0	.79
California	Union Iron Works	0	0
Colorado	Cramp & Sons	3	5
Maryland	Newport News	0	.84
South Dakota	Union Iron Works	0	0
SHEATHED PROTECTED CRUISERS.			
Denver	Neafie & Levy	51	55
Des Moines	Fore River Engine Co.	45	50
Chattanooga	Lewis Nixon	37	45
Galveston	Wm. R. Trigg Co.	33	36
Tacoma	Union Iron Works	20	20
Cleveland	Bath Iron Works	61	64
St. Louis	Neafie & Levy	0	0
Milwaukee	Union Iron Works	0	0
Charleston	Newport News	0	0
MONITORS.			
Arkansas	Newport News	61	66.54
Nevada	Bath Iron Works	90	91
Florida	Lewis Nixon	68	70
Wyoming	Union Iron Works	75	75
TORPEDO BOAT DESTROYERS.			
Bainbridge	Neafie & Levy	95	98
Barry	Neafie & Levy	90	90
Chauncey	Neafie & Levy	90	90
Dale	Wm. R. Trigg Co.	96	97
Decatur	Wm. R. Trigg Co.	97	98
Hopkins	Harlan & Hollingsworth	75	76
Hull	Harlan & Hollingsworth	74	75
Lawrence	Fore River Engine Co.	99	99
MacDonough	Fore River Engine Co.	98	98
Paul Jones	Union Iron Works	85	85
Perry	Union Iron Works	89	89
Preble	Union Iron Works	87	87.5
Stewart	Gas Engine & Power Co.	55	55
Truxton	Maryland Steel Co.	70	72
Whipple	Maryland Steel Co.	69	71
Worden	Maryland Steel Co.	69	71
TORPEDO BOATS.			
Stringham	Harlan & Hollingsworth	98	98
Goldsborough	Wolff & Zwicker	95	95
Blakely	Geo. Lawley & Son	98	98
DeLong	Geo. Lawley & Son	98	98
Nicholson	Lewis Nixon	91	92
O'Brien	Lewis Nixon	96	98
Thornton	Wm. R. Trigg Co.	97	97
Tingey	Columbian Iron Works	68	68.5
Wilkes	Gas Engine & Power Co.	84	85
SUBMARINE TORPEDO BOATS.			
Plunger	Lewis Nixon	19	25
Adder	Lewis Nixon	75	85
Grampus	Union Iron Works	51	51.5
Moccasin	Lewis Nixon	70	80
Pike	Union Iron Works	50	50
Porpoise	Lewis Nixon	64	70
Shark	Lewis Nixon	63	68

CONTRACT FOR SOUTHWEST PASS DREDGE.

The Wm. R. Trigg Co., Richmond, Va., has secured the contract for the government dredge for the Southwest pass of the Mississippi river, for which Capt. J. C. Sanford, United States engineer at Charleston, S. C., opened bids on Aug.13. The pumping machinery for this dredge will be furnished by the Bucyrus Co. of South Milwaukee, Wis., and will consists of two 20-in. single-suction centrifugal dredging pumps with direct compound condensing engines and the necessary incidental dredging outfit. This dredge will be the largest and most complete sea-going dredge which has yet been built for the United States government. It is, moreover, the first sea-going hopper dredge which the government has purchased with steel hull and twin screws. The dimensions of this hull will be 271½ ft. over all, 47½ ft. molded beam, and 23 ft. molded depth. She will have a hopper capacity of about 2,000 cu. yds. The propelling engines will be compound condensing with cylinders of 20 in. and 40 in. by 30 in. stroke. In other respects the dredge will be a complete sea-going ship, with extensive cabin accommodations for officers and crew and with complete electric light outfit. She is designed for a speed of not less than 10 knots per hour.

PREPARING FOR DELIVERY OF AMERICAN COAL.

The state department at Washington has received a communication from Consul General Mason at Berlin in which he says that the central office for the preparation of commercial treaties at Berlin in a recent circular publication points out as especially significant signs of the times the facts that elaborate preparations are now in progress for the permanent supply of American coal to northern France and Switzerland. The present preparations include the creation in a port of northern France of an immense receiving station, equipped with modern American machinery for unloading, screening and grading coal and for making briquettes from the refuse dust and slack. For the Swiss trade the French railways have granted a special freight rate of 12 francs, $2.31 per ton, and with this concession it is expected that the American coal will be able to undersell and replace the supply which Switzerland has hitherto drawn almost exclusively from Germany.

LAUNCH OF ENGLISH SUBMARINES.

The first of the submarine boats being built for the British admiralty will be launched within two weeks. In addition to the five boats of the Holland type there is also, it is understood, a submarine of an English design being built to the order of the admiralty, and it is rumored that several more will be provided for in next year's naval estimates. The admiralty is now convinced of the utility of these boats and an effort is to be made to get on a level with France in this matter. At the present moment the French have thirty-four in various states of manufacture—twenty-nine electric submarines and five submersibles. While the British boats will not be quite so fast as some of the French boats, they are expected to be superior in other ways, such as being able to rise and disappear more quickly. The dimensions of the five boats of the Holland type are 63 ft. 4 in. over all and 11 ft. 9 in. beam, with a displacement when submerged of 120 tons. One torpedo expulsion tube is formed at the extreme forward end of the boat and four of the 18-in. Whitehead torpedoes will be carried. The gear is being arranged so that the torpedoes may be discharged while the boat is stationary or running at any speed and when the vessel is awash or submerged.

Ingress and egress will be through a conning tower of armored steel, 4 in. thick and 32 in. in external diameter, fitted with observation ports. The propulsion of the vessel awash is by a gasoline engine with four single-acting cylinders, water-jacketed. The speed may be varied from 200 to 360 revolutions a minute, giving the maximum horse power of 190. The boat will have only one propeller. The speed awash is expected to be 8 knots, and fuel is to be carried for a radius of 400 miles at that speed.

When the vessel is submerged, propulsion is by an electric motor, which, like the gasoline engine, drives the shaft from the propeller through gearing with clutch connection. This gearing enables both the gasoline engine and the motor to be at a lower level than the shaft, which is on the center line of the boat. For diving, the boat will be fitted with a horizontal as well as a vertical rudder; while, at the same time, a simple system of automatically arranging the disposition of the water ballast overcomes any lack of horizontal stability consequent upon the diving action. Automatic means also determine the angle of diving or of rising to the surface, and obviate submergence to excessive depths. By a special arrangement, a view of the surface from a depth that prevents the submarine being seen can be obtained.

MANCHESTER CANAL IN DEEPER DEBT.

Details of the half-yearly meeting of the Manchester Ship Canal Co., held at Manchester recently, have just been received. In moving the adoption of the report Chairman Bythell referred to the increase in the size of vessels and said that they had now sufficient depth for large vessels and they had means of increasing that depth at moderate cost. Their docks had the most modern appliances and they had now under construction a large transit shed. Works which would cost £50,000 had already been begun which would, he said, deepen the canal in order to allow of the passage of the largest vessels. He did not think their returns for July, August and September would compare favorably with last year, but after that they might look for more activity. Their main hope at present was in the extension of business with the American ports. He considered it would be absurd to be disheartened because they happened to be passing through a period of acute trade depression which was affecting every one alike.

After the motion had been seconded, Marshall Stevens criticized the report. He said that the net result of the past twelve months' trading was a loss of £200,000, the bulk of which had gone to swell up the amount due for interest to the Manchester corporation, now nearly as large as the whole capital amount of the first mortgage debentures, and the shareholders were liable at any time to lose their property. He thought a definite understanding should be come to with the Manchester corporation with regard to the payment of interest and principal.

The chairman held that that was not the place to discuss difficult and intricate financial affairs. If, however, any scheme were laid before the directors by the shareholders which would be for the interests of the company it would, he said, be carefully considered. The report was adopted.

JAPAN ENCOURAGES SHIP BUILDING.

In his report to the British government on the trade of Nagasaki for last year Acting-Consul Forster states that the only industry at Nagasaki is that of ship building. At the Mitsu-Bishi dock yard and engine works no expense is spared to bring it up to the highest standard of efficiency, and he says that the work turned out in the local ship building yard compares favorably with that of the Clyde. During the past year new blacksmiths', joiners' and machine shops have been erected, the machine shop being fitted with eight steam hammers ranging from seven tons to half a hundred weight. In order to educate young men for the machine shop a technical training school has been built with accommodations for 250 boys. Two vessels of 600 ft. in length and two of 300 ft. can be built at the yard at one time. A new dock over 600 ft. long and 38 ft. deep at the entrance is to be constructed by the company, but it will not be completed for another two years. Last year four ocean steamers, ranging from 2,243 tons to 643 tons, were completed, while at the end of the year there were under construction two passenger steamers of 6,300 tons each for the American line of the Nippon Yusen Kaisha; two 2,741-ton ore carriers for the government iron foundry near Maji; a passenger steamer of 2,389 tons for the Yangtsze service of the Osaka Shosen Kaisha, and several smaller craft; while a 710-ton steamer is being built and fitted with the latest salvage plant for the company's use.

The Atlantic Coast Steamship Co. of New York was incorporated this week with a capital of $500,000, to establish steamship lines to touch points on the Atlantic and Pacific coasts, including Canada, Newfoundland and the great lakes, South America, Cuba and the West Indian islands. The directors are Darius O. Mills, Ogden Mills, J. L. Crosthwaite, George W. Graff, Lewis A. Hall, Charles R. Flint and W. D. Walker.

For navigation charts apply to the Marine Review.

DILEMMA OF THE TRAMP STEAMER.

According to a writer in the New York Evening Post the owners of tramp steamships regard the present situation in shipping as the most critical in years. Within the past five years the extension of the service of established lines, the establishment of new lines and the building of the enormous freight steamships, of which the Cymric and Celtic are types, have practically driven the tramps from the main route of commerce, compelling them to pick up trade elsewhere. Between New York and the great European ports, such as London, Liverpool, Hull, Newcastle, Leith, Bristol, Bremen, Rotterdam, Hamburg and Havre, the regular lines are now in a position to handle all the freight that is offered, and the smaller chartered steamships, which the lines themselves or outside agents frequently dispatched a few years ago to supplement the established lines, are never likely to be called upon again except in cases of an extraordinary stimulation of trade. At present the tramp steamships are still employed for a great deal of the transatlantic trade, but it is chiefly between the lesser ports, or between a great port on one side and a lesser port on the other. In the cotton season, for instance, a great many tramps leave the southern ports in this country with cargoes of cotton for Havre, Liverpool and Bremen. Coffee, lumber and sugar are carried by them also.

The natural development of the shipping trade in the last fifty years has brought about the replacement of the sailing ship by the tramp steamer, and this in turn by the regular lines of freighters. Exactly the same order of events is followed with respect to any individual port, though the changes come much more quickly nowadays. The trade with Australia, for instance, was carried on almost exclusively by sail up to three years ago. Now there are three regular lines of steamers, one American and two English. It should be noted that the establishment of a line of steamboats does not necessarily mean that the tramp boats have been superseded. In numerous cases what is nominally a new "line" is in reality a combination of the owners of a certain number of tramps who have put their boats together under one management and giving them the advantage of sailing on a regular schedule. Some of the ships now plying between this port and Australia were originally built for the Australian meat trade and intended to land at the English ports. So the distinction between a tramp and a liner is not always a hard and fast one.

It must not be supposed from the facts just cited that there is no longer a place in the world's commerce for the "little cargo boats" ready to be chartered anywhere at any time, and carrying any commodities. In point of fact, there are now many more tramp steamers in commission than there ever were before. New and large ones are being built in good numbers. The problem is for these boats, crowded off, as they are, from traffic between the most important routes, to find new routes and new trades. For the new boats, of course, there is no apprehension. If trade were not waiting for them, they would not have been built. But the older and smaller tramps are having a harder and harder time to gain a living, and men in the shipping business predict that more of them will be withdrawn this year than in any year for a long time. As one steamship agent expressed it:

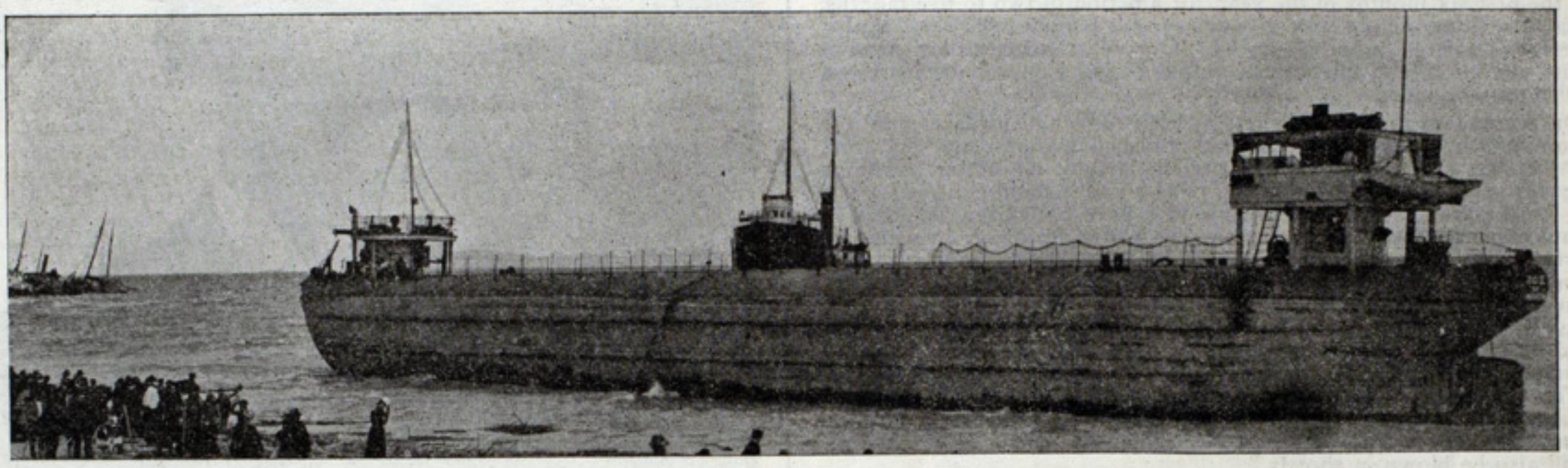
"By rights, a tramp steamer ten years old is now good only for the scrap heap. The South African and Philippine wars, however, withdrew a great many ships from the regular lines, and for the time being there was trade enough for every ship in condition to make a trip. Many old boats that had not made a voyage for years were able to find business. Of course, it can be readily understood that every warship in foreign waters and every regiment on foreign soil means employment for many vessels in transporting coal, fodder and supplies of every sort. Add this to the normal total of trade, and it means good times for ship owners. When the freight rates were high, many agents chartered boats on two or three year contracts, and still have them on their hands. Before very long, however, a lot of these boats will be put out of business, the oldest first, until there are no more than can get cargoes."

What becomes of the tramp steamers that have been compelled to leave the main traveled routes is a pertinent question, but it can hardly be answered in general terms. The history of a single ship is sometimes eventful. For instance, one vessel that was making trips up to five years ago between New York and Liverpool is just at present on the way from Rangoon to Japan, having within the past few months discharged cargoes at Hong Kong, Malta and Port Said. Another steamer got an order to carry steel rails to Vladivostock, Siberia. After taking all the rails that happened to be ready, she took on 300 tons of ammunition for the army at Manila, and then, having space in her hold, though heavily loaded, filled up with cotton for Japan. She expected to bring back hemp from Manila, but hemp not being obtainable she came home from Africa with manganese ore.

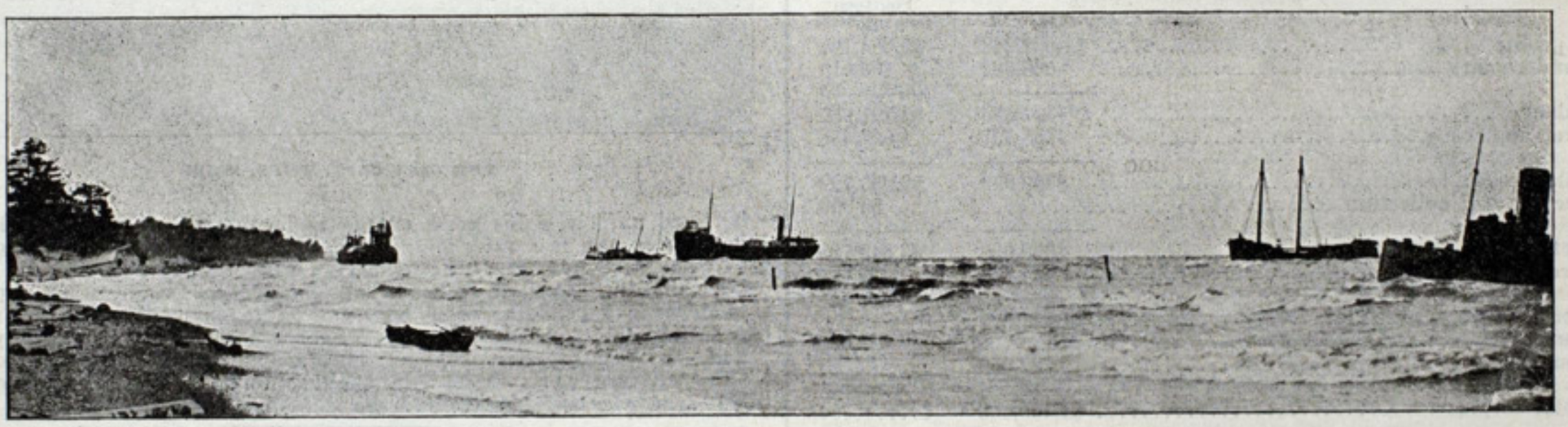
There are plenty of ports visited only by tramps in the Pacific and Indian oceans and on the South American coast. When the destination of a parcel or shipment reads, "via Singapore," or some similar designation, it often means that it is to be transhipped to a tramp steamer which happens to be plying between Singapore, or whatever the port may be, and the port of destination, which is probably too small to be supplied with a regular line of its own. Draught and the width of dock gates are the governing factors when the modern freighters of big capacity and small coal consumption are concerned. In the leading Mediterranean ports, for instance, the 1,000 or 2,000-ton freight boats were displaced by the 3,500 or 4,000-tonners, and these in the last few years by those of 6,000 to 7,000 tons. The big boats monopolize the deep-draught ports such as Genoa, Marseilles, Algiers, Naples, Ancona, Constantinople, Port Said, Barcelona and Gibraltar, but there are still ports of lesser depth, as Smyrna, Piræus, Salonica, Venice, Civita Vecchia, Caen and Bilbao, where the smaller ships, be they tramps or liners, have to get the trade, because no others can get in.

It is in great part by the tramp steamer, crowded out of some profitable route, that new trades and new routes are originated and developed. Promoters will not build boats of their own for an untried and uncertain venture, but will charter tramps, as old, probably, and as cheap ones as they can get. For instance, when the Klondike was opened up there was a demand for boats to take prospectors there. Almost anything with American registry would do. Any sort of a tub could fairly coin money that first year, but new ships, built since for the special purpose, have now changed the situation completely. An example of a new line of trade recently developed by the tramp is the carrying of nickel ore from New Caledonia. Half-a-dozen tramp steamers are in this business, carrying up to 9,000 tons in a cargo. The West Indian fruit trade is another; the nitrate trade is a third. The large type of British tramps find their best field in the orient, while the small sailing tramps have to themselves the South sea trade in the South sea islands, where coal is not to be had.

Wrecks above Port Huron after the Storm of Saturday, Sept. 7.



Pauly and Amaranth. Steamer Wawatam and whaleback barge 202.



Barge 202. Pauly and Amaranth. Wawatam. M. W. Page. Tug Sarnia.

ANNUAL REPORT OF REPUBLIC IRON & STEEL CO.

The annual report of the Republic Iron & Steel Co. shows a falling off in surplus from June 30, 1900, to June 30, 1901, of $1,112,384. The report shows net profits during that period of only $309,099, while $1,421,483 in dividends were disbursed. Alexis W. Thompson was elected president of the company, succeeding Randolph S. Warner, resigned. Other officers elected follow: John F. Taylor, Archibald W. Houston, William E. Taylor and William Barrett Ridgely, vice presidents; John F. Taylor, treasurer; Y. D. Haagsma, secretary; executive committee, G. Watson French, chairman, Alex W. Thompson, John F. Taylor, Harry Rubens and William E. Taylor. The number of directors was reduced from eighteen to fifteen and the following were elected for three years: Peter Kimberley, William Nelson Page, Archibald W. Houston, Edwin N. Ohl and William Barrett Ridgely. The new directors are Messrs. Page, Ohl and Ridgely. The retiring directors are George M. Bard, L. E Cochran, James C. Corns and Myron C. Wick, one of them retiring on account of the reduction in size of the board. President Warner says in his report in part:

"The year covered by this report has been an unusual one for the company in many respects. We did not reach an agreement on the wage scale for our mills for the year commencing July 1, 1900, until late in September. Our mills were idle during July, August and September pending this settlement; and, as a further consequence, the tonnage of finished material produced during the second fiscal period was 254,801 tons less than the production for the previous fourteen months' period, and the average selling price very materially less. To improve the physical condition of our blast furnaces we were obliged to have them all out of blast during the first six months of the year, for a period of two to five months. On account of this the pig iron production was 175,186 tons less than for the previous fourteen months' period. Our blast furnaces are now in first-class condition, and our annual output of pig iron will be increased to 500,000 tons or more.

"On account of the long idleness at both mills and furnaces, and the reduction in tonnage produced of both finished material and pig iron, during the first six months of this period, it took all of our earnings until April to absorb the fixed charges, repairs and general expenses. The repairs for the year and expenses, while idle, have both been absorbed in operating expenses. In addition to this we had a shrinkage in values of our inventory to contend with, occasioned by the sharp decline in value in both the raw and finished material on hand during the first six months. Our inventory as of June 30, 1901, was gone over very carefully by our executive committee, and very conservative values were placed on the raw and finished material on hand, and in no instance above actual cost. Many important improvements and renewals have been made during the year. The new billet mill which we are adding to our Bessemer plant at Youngstown, O., is practically completed. This will increase our output of billets to 1,000 tons or more per day. The new blast furnace at Thomas, Ala., will also be blown in shortly."

The income account of the company for the year ending June 30, 1901, as compared with June 30, 1900, follows:

	Year 1901.	Fourteen months, 1900
Gross profits	$1,034,248.	$5,684,100
Imp. and repairs	566,622	893,013
Balance	$467,626	$4,791,087
Ded. val. materials	158,527	1,097,358
Balance	$309,099	$3,693,729
Reserve for bad collection		50,000
Net profit	$309,099	$3,643,729
Preferred dividend	1,421,483	1,421,679
Deficit	$1,112,384	
Surplus		$2,222,050
Previous surplus	2,222,050	.....
Total surplus	$1,109,666	.....

The general balance sheet as of June 30 compares as follows:

Assets.	1901.	1900.
Real estate, plants, machinery, etc.	$41,093,724	$41,142,251
New construction	2,382,378	1,218,203
Stock in other companies	147,200	547,200
Nor. blast fur. imp	100,674	.....
New gas pipe lines, etc.	245,171	116,730
Raw and finished materials	3,328,850	4,132,730
Accounts and bills receivable	2,527,209	3,008,968
Cash on hand	1,127,107	1,203,132
Total	$50,952,315	$51,369,216
Liabilities.		
Preferred stock	$20,306,900	$20,306,900
Common stock	27,191,000	27,191,000
Current accounts payable	1,685,350	1,023,907
Dividend July 2, 1901	355,370	355,370
Installment on coal purchase	185,000	214,000
Reserve for tax, etc	47,386	85,988
Reserve for bad collections	61,642	.....
Surplus	1,109,665	2,222,040
Total	$50,952,315	$51,369,216

Regarding the showing of the company President Thompson said: "The decrease in earnings has been due almost entirely to new construction. By this I do not mean improvements which have been charged to operating expenses. The orders already on the books of the company guarantee steady operation until the first of the year, and we are in a good position to replace what surplus we have lost."

One of the large ship building concerns advertises elsewhere in this issue for a leading marine engine draftsman.

STEAMER WM. S. MACK.

A large freight steamer to be launched at the Lorain works of the American Ship Building Co. on Saturday, the 21st inst., will bear the name Wm. S. Mack. It is certainly fitting that the memory of the late Capt. Mack should be honored by a modern steel freighter worthy of the name. As his death occurred only a few years ago, he is, of course, remembered in all parts of the lakes; remembered as a true specimen of the type of vessel men who had much to do with the development of lake commerce. He was a prominent figure in lake vessel circles for several years before his death, and it has been often said of late that had

THE LATE CAPT. WM. S. MACK.

he lived until now his great energy and capacity for work would have gained for him first rank among self-made business men of the country.

The new steamer, to be owned by Mrs. Mack and others, is 366 ft. over all, 346 ft. keel, 48 ft. beam and 28 ft. depth. Engines are triple expansion, with cylinders of 20, 33½ and 55 in. diameter and 40 in. stroke, to be supplied with steam from two Scotch boilers of 12 ft. 10 in. by 13 ft. The carrying capacity is about 4,800 gross tons and the approximate value $220,000. This vessel will have been completed within four months. The keel was laid June 23 and she is to be delivered Oct. 15.

MAIDEN TRIP OF HAVERFORD.

The new American line steamship Haverford arrived at New York on Monday, having made her maiden trip from Southampton in 11 days, 7 hours and 31 minutes. She is the first of the line's new fleet, designed more for carrying capacity than speed. The Haverford was built at Clydebank, Scotland, by John Brown & Co. and is a twin-screw vessel of 10,000 tons, is 530 ft. long, 59 ft. beam and 39 ft. deep. Only one class of cabin passengers and third-class passengers are carried on her. The accommodation for cabin passengers is located in a deck house amidships on the promenade and saloon decks, where the motion is least perceptible. On the promenade deck there is a large ladies' room, upholstered in the best style and fitted with tables and easy chairs. The smoking room is also on the promenade deck, and also a large and well lighted library, with well stocked book-cases and convenient writing tables. The dining saloon, which is on the saloon and state room deck, immediately below the promenade deck, has seats for 112 passengers. The accommodation for third-class passengers is on the upper deck and is designed to give this numerous class of passengers the greatest amount of comfort. There are a large number of small rooms for married couples and families. There is also a large smoking room for third-class passengers located on the saloon deck.

Messrs. Harland & Wolff, Belfast, launched recently the first of three large twin-screw steamers which are being built to the order of Messrs. Ismay, Imrie & Co., for the White Star line, for the service between London and New Zealand, which has for so many years been run in connection with Messrs. Shaw, Savill & Albion Co., Ltd. The steamer has been named the Athenic, and will be followed by the Corinthic and Ionic, sister ships in all respects. She is 500 ft. in length, with a breadth of 63 ft., and a depth of 41 ft., with a register tonnage of 12,500 tons. All three vessels will have exceptionally comfortable accommodation for ninety-four saloon, eighty-four second, and 186 third-class passengers, in addition to a large cargo capacity.

MORE THAN A BILLION AND A HALF.

EXPORTS FROM THE UNITED STATES DURING THE YEAR ENDED AUGUST 31—AN INCREASE OF MORE THAN 50 PER CENT. IN THE PAST FIVE YEARS.

Exports from the United States in the year ended August 31, 1901, were $1,500,613,236. This is the first time in the history of our export trade that the figures for a twelve months' period have crossed the billion-and-a-half line. The bureau of statistics, in its statement of imports and exports, issued each month, gives a total for the latest twelve months and compares it with the corresponding twelve months in preceding years, thus giving a convenient method of not only measuring the foreign commerce, but also measuring its growth. This table shows the imports and exports in each twelve months ended with August 31, from 1896 to 1901, as follows:

Year ended August 31.	Imports.	Exports.
1896	$737,163,827	$ 906,403,525
1897	756,673,034	1,066,603,779
1898	623,192,020	1,236,643,922
1899	723,232,313	1,269,504,882
1900	848,675,810	1,399,000,520
1901	843,681,360	1,500,613,236

It will be noted that the exports have, during the five-year period from August 31, 1896, to August 31, 1901, increased more than 50 per cent., while the imports have increased less than 13 per cent. While it is not customary to calculate the annual statistics of our commerce by other than fiscal or calendar years, the fact that the export record has, for the first time, exceeded a billion-and-a-half dollars in a twelve months' period, seems to justify these comparative figures for the period under consideration.

The growth in exports during the period since 1896, in which the increase in exports has been more than fifty per cent. compared with an increase of less than 15 per cent. in imports, has, as is well known, included all great classes of products and manufactures. Agricultural products now form 63.7 per cent. of the total exports; in 1896 they formed 63.9 per cent. Manufactures now form 29 per cent. of the total exports; in 1896 they formed 28.3 per cent. During the last year, however, the exports of manufactures have not kept pace with those of other industries. In the eight months ended with July, 1901, the latest month in which the details are accessible, exports of manufactures fell $32,000,000 below those of the corresponding months of last year, while exports of agricultural products were $57,000,000 greater than those of the corresponding months of last year. This reduction in exports of manufactures is about equally divided between copper, and iron and steel, the reduction in copper exports being about $16,000,000, and in iron and steel about $16,000,000. The reduction in copper exports is chiefly due to the decreased demand for copper in other parts of the world for use in electrical and other industries. In exports of iron and steel the reduction is apparently due somewhat to the partial suspension of manufacturing activities in certain lines in the past few weeks, partially to the reduced demand abroad, partially to the reduction in prices of the articles exported, and in large part to the fact that the exports of Hawaii and Porto Rico, which were included in last year's statistics, are not included in the figures for the present year—the total exports of iron and steel of those two islands in the fiscal year 1900 having been about $7,000,000.

The phenomenal growth in exports is illustrated in another form by the fact that the monthly statements have not, for more than two years, fallen below the million-dollar line, while, as already indicated, they have for the first time passed the billion-and-a-half mark for a twelve-months' period.

LAUNCH OF STEAMER HURONIC.

The steamer Huronic, the largest fresh water vessel ever built in Canada, was successfully launched at the yards of the Collingwood Ship Building Co., Collingwood, Ont., last Thursday. A special train from Toronto carried a number of distinguished visitors to Collingwood to witness the ceremony. The vessel was christened by Miss Long, the daughter of President John Long of the ship building company. The Huronic is a passenger and package freight steel screw steamer and is building for the North West Transportation Co. of Sarnia, from designs by Hugh Calderwood, manager of the ship building company. She is constructed of open hearth steel throughout and is of the following dimensions: Length over all, 325 ft.; between perpendiculars, 308 ft.; beam, 43 ft.; molded depth, 27 ft. She will have accommodations for 200 saloon passengers and a large number of steerage passengers. A feature of the design which will be appreciated by the traveling public is the dining room, which is placed athwartships and extends the full width of the lower cabin, being 52 ft. long and 32 ft. wide. It is finished in quarter-sawed white oak. The smoking room, also finished in white oak, is at the extreme after end of the upper cabin. The vessel is equipped with two tiers of cabins, one above the other, with a shade deck extending fore and aft. Deck room is provided for 700 tons of package freight and the lower hold is divided into five compartments of a combined capacity for 80,000 bushels of wheat. The propelling machinery was built by Messrs. John Inglis & Sons, Toronto, from designs by their superintendent, Mr. James C. Smith, late of Chicago and West Superior. The machinery consists of a vertical triple-expansion engine with cylinders 26, 42 and 70 in. in diameter by 42 in. stroke. Steam is supplied by four Scotch boilers, 12 ft. 6 in. in diameter by 12 ft. long. The steamer is designed for a speed of 15½ miles loaded. She is being built under the inspection of Capt. F. D. Herriman and will be given the highest rating for a vessel of her class by the Bureau Veritas and the Great Lakes Register.

The new Great Eastern grain elevator at Buffalo is practically finished. It is of steel entirely and of the circular-tank type, with a capacity of 2,500,000 bushels. The machinery is all run by electric power from Niagara Falls and consists of forty-one motors of 850 H. P. in the aggregate. The new Dakota, adjoining, which may be finished this fall, will also be a steel structure and will be run by electricity. This will give Buffalo harbor four great steel-tank elevators.

PRELIMINARY TRIAL TRIP OF RETVIZAN.

Philadelphia, Sept. 18, 1901.—The preliminary or builders' trial of the Russian battleship Retvizan was probably the most successful ever run by the Cramps. It began on Wednesday morning, Sept. 11, the ship remaining out until the following Monday. During this time the Retvizan was put through many exacting tests and demonstrated to the satisfaction of all concerned that she is in good condition to meet the requirements of the official trial, to be run next month off the Massachusetts coast, in which she must maintain a speed of 18 knots an hour during twelve consecutive hours' steaming.

Primarily the run just completed was for a test of the structural strength of the ship under gun fire. When off Five Fathom bank last Saturday, under the direction of Brig. Gen. Brynk, assistant to the chief of ordnance of the Russian navy, all of the guns were fired, first with a half charge and then with the full or regulation charge. In addition to the 12-in. turret guns this included the twelve 6-in. rapid-fire, twenty 75-millimeter, twenty 47-millimeter, six 37-millimeter and two 2½-in. special guns. The first fire of the 12-in. turret guns at right angles with the keel produced no effect discernible by the experts. The guns were then pointed across the decks, longitudinally with the keel, and discharged in broadside. The concussion demolished a temporary bulkhead under the main deck and disarranged the compasses. This was the only damage apparent after the closest scrutiny. The instruments failed to indicate a depression of the turrets greater than 1-64 in., and a basket of rabbits placed therein, before the guns were fired, was taken out with its occupants alive and without the slightest injury. The turret guns were not fired from within the turrets but by electrical communication from a safe distance on deck. The following Russian officers, several of whom will be assigned to the battleship when she goes in commission, witnessed the firing of the guns and noted their effect on the vessel: Brig. Gen. Brynk; Capt. E; N. Stchdnsnovitch, who will command the Retvizan; Lieut. Com'dr Makedonsky, executive officer; Chief Engineer Franzkevitch; Lieut. Col. Petroff, ordnance officer; Lieut. Skorodhoff, torpedo officer; Dr. Jaffreaux, surgeon; Lieut. Phillepov, paymaster; Lieut. Kletlinsky, ordnance officer; Lieut. Brink, assistant engineer; Capt. Ossipop, navigator; Capt. Golubzoff and Capt. Patvinsky, inspectors of ordnance; Engineer Dom, from the metal works at St. Petersburg, and Capt. Moeller of the Russian artillery, who, after reporting on the strength of the turrets, will finally adjust the guns.

On the speed trial, which was run from Five Fathom bank to Northeast End lightship for the purpose of standardizing the screws, the vessel was alternately under forced and natural draft. The sea was very rough but the average of 17.5 knots was made without difficulty. The indicated horse power was 16,121 and the revolutions ninety-five per minute. It was not thought necessary to make more than three runs of the course, which is 11.12 knots between the lightships, sufficient data having been secured on which to base the calculations for the official trial trip. Chief Engineer Maginn was in charge of the engine room. He will go to Russia with the vessel. John H. Clarke of the General Electric Co. was on board to look after the electric installation, and a few invited guests made the trip. Edwin S. Cramp, superintending engineer of the Cramp company, is extremely pleased with the performance of the Retvizan and has no reason to doubt her success on her final spurt. When at full speed the ship developed remarkable steadiness, there being practically an absence of vibration.

The Neafie & Levy Ship & Engine Building Co. will launch next week the torpedo boat destroyer Chauncey, a sister ship to the Bainbridge, which in a few days will be sent on her official trial trip. This vessel will be christened by Miss Mae Chauncey Stevens of Grand Rapids, Mich. The Reading Railroad Co.'s steel ocean tug Carlisle was launched from this yard last Saturday. It had been proposed to make the occasion a gala one, but out of respect to the dead president the ceremonies were omitted. The Carlisle is 170 ft. long, 29 ft. beam and 18 ft. deep. She is equipped with triple-expansion engines of 1,000 H.P., with cylinders of 18, 28 and 45 in. diameter and 30 in. stroke. The vessel carries a crew of twenty men and is practically a duplicate of the other tugs in the company's fleet, of which this steamer is the eighth. The company also owns and operates fifty-three ocean-going barges of 1,500 tons capacity each and has now under construction six additional at the yard of Robert Palmer & Sons, Noank, Ct., to be delivered this fall. Four of these barges, yet to come, are of 1,500 tons capacity and two are of 3,000 tons capacity. The present capacity of the fleet is 2,000,000 tons of coal per annum. Up to June 30 nearly 1,600,000 tons had been transported to Boston and other New England ports.

The examination of the exploded boiler of the steamer City of Trenton has been concluded by the experts and the case is now in the hands of the coroner. The jury was composed of the following well-known experts: Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works; Joseph S. Levering Wharton of the Harrison Safety Boiler Works; John H. Baizley of the John Baizley Boiler Works; John S. Naylor of the Peoples Works; Henry C. Francis, president of the Kensington Engine Works; Henry Goldner of Henry Goldner & Sons Boiler Works; George Ricards of the Corliss Engine Co.; Henry J. Hartley, superintendent of the boiler works at Cramps; Robert K. Reding, master mechanic of the Pennsylvania railroad; John S. Clampitt, superintendent of the boiler shop of the Philadelphia & Reading railroad; George Bellvue, captain of the Red Star tugs, and James McCaulley. Their conclusion, after an examination lasting three days, was unanimous that the explosion was directly due to the crown sheet having been burned and the case was pronounced to be not at all difficult of analysis. It is expected that the responsibility will shortly be placed. The boiler was radial stayed and the stays were found in good condition, the crown sheet having simply been torn down and away from their support.

During the past twenty-five years, according to "Glasgow and its Shipping," the water area and docks of Scotland's chief port has increased from 105½ acres to 205¾ acres, the length of the quays from 7,109 yards to 15,115, and the number and lifting capacity of the City Trust cranes from thirteen of from three to sixty tons to eighty-four of from one and one-half to 130 tons.

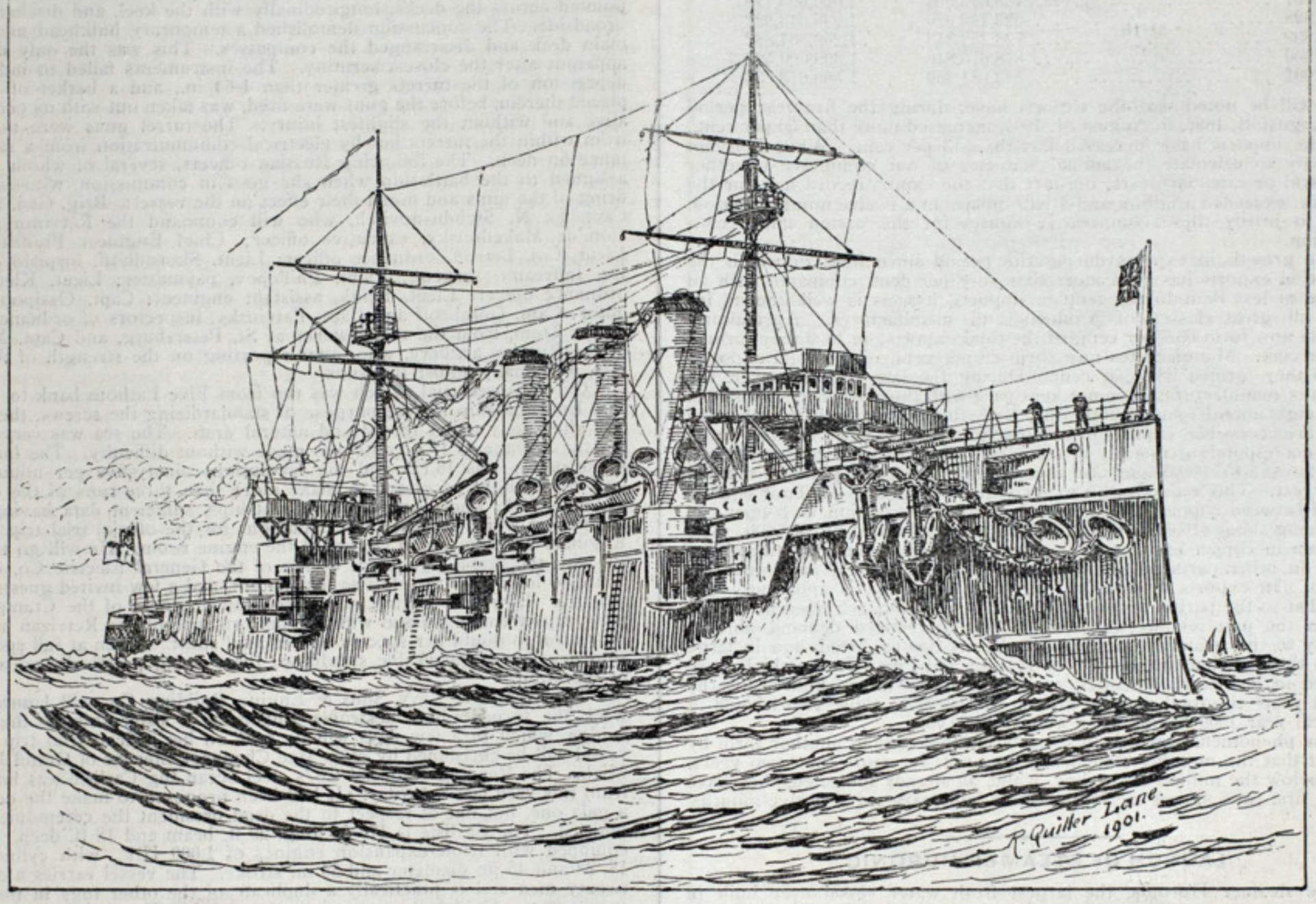
A new chart, in colors, of Erie harbor and Presque Isle, has just been issued and may be had from the Marine Review. A new chart of Buffalo harbor and Niagara river to the falls is also in print.

SOME NOTABLE SCOTTISH PRODUCTS.

TWO CRUISERS OF THE COUNTY CLASS HAVE JUST BEEN LAUNCHED FROM CLYDE YARDS—DESCRIPTION OF THE VESSELS WITH THEIR ENGINES AND MACHINERY.

[Special correspondence to the Marine Review.]

Glasgow, Sept. 10.—One of the most important of the recent products of Scotch ship yards has just been put into the water by the Fairfield Ship Building & Engineering Co., Ltd., Glasgow. This is H. M. S. Bedford, a first-class cruiser of 9,800 tons and 22,000 I.H.P. She belongs to what is now known as the County class, of which five were ordered by the admiralty from Clyde firms—two from the Fairfield company, two from the London & Glasgow Engineering & Ship Building Co., Glasgow, one from William Beardmore & Co. (late R. Napier & Sons), and one



FIRST-CLASS CRUISER ESSEX, BRITISH NAVY—ONE OF A CLASS OF TEN.

from Armstrong, Whitworth & Co., Ltd., Elswick-on-Tyne. The Bedford is the first of the lot to be ready, well within contract time. Her dimensions are:

Length between perpendiculars	440 ft.
Breadth, moulded	66 ft. 2 in.
Normal draught	24 ft. 6 in.
Displacement at load draught	9,800 tons.
Normal freeboard amidships	19 ft.
Engine power	22,000 I.H.P.
Boiler pressure	300 lbs.
Speed	23 knots.
Normal coal capacity	800 tons.

The Bedford has side protection extending over a length of about 350 ft. from the stem to the armor bulkhead, which is 3 in. thick. The side armor is of specially hardened steel of three thicknesses—4⅛ in., 3 in. and 2 in.—the 4⅛ in. armor extending from the armor bulkhead forward for a distance of about 240 ft., the 3-in. armor for a distance of about 40 ft., and between this and the stem there is 2-in. nickel steel armor. The protective deck proper extends from stem to stern, and ranges in thickness from ¾ in. within the range of side armor to 2 in. thickness outside. Another deck 1¼ in. to 1 in. in thickness forms a crown over the side armor and armor bulkhead, etc. The armor has been supplied by (casemates) Cammell & Co., Ltd., (barbettes and side armor) William Beardmore & Co., and (conning tower) John Brown & Co., Ltd. The coal bunkers range along the sides of the machinery compartments both below and above the lower deck, and are provided with fittings for the rapid handling of the coal. The vessel's normal coal capacity is about 800 tons, but this can be doubled if necessary, ample space being allotted for this essential requirement.

The Bedford has two sets of triple expansion engines fitted in two water-tight compartments, each set having four inverted cylinders working on four cranks. Each high pressure cylinder is 37 in. diameter, each intermediate 60 in., and each of the low pressure cylinders 69 in., all adapted for a stroke of 3 ft. 6 in. The high pressure and intermediate pressure cylinders are each fitted with a piston valve, and each low pressure cylinder with a double-ported slide valve with a relieving ring at the back. All the valves are worked by the usual double-eccentric and link-motion gear. The reversing is effected by means of double-cylinder steam engines, with gear of the all-round type, hand gear also being fitted. The crank thrust and propeller shafting is of forged steel and hollow. Each of the propellers has a boss of gun metal fitted with three adjustable blades of manganese bronze. The main condensers are placed at the back of the engines, and are of cast brass of oval form fitted with brass tubes, the condensing water being supplied by four centrifugal pumps of gun metal, each fitted with an independent engine. The feed, bilge, and hot-well engines are all independent and separate from the main engines, steam for these and all the other auxiliary machinery being supplied by a special range of steam pipes. The auxiliary exhaust steam is arranged to discharge to the auxiliary condensers. The atmosphere and the low pressure receivers will also be utilized for working the evaporators. There are two auxiliary condensers, each fitted with a circulating pump and a small air pump. The vessel will have a complete distilling plant to supply fresh water to the boilers and for drinking purposes, four sets of engines and dynamos for producing the necessary current for electric lighting, two double-cylinder direct-acting engines with the necessary gear for steering purposes, two complete sets of air-compressing engines and pumps, with the necessary air reservoirs and columns for charging torpedoes, and one ice-making machine of the cold-air type, including an ice-forming chamber and a pump for circulating water in the air cooler.

For steam generation there is an installation of thirty-one water tube boilers and economizers, all of the latest Belleville type. The boilers are arranged in three groups, each group fitted in a water-tight compartment, and they are designed to work at a pressure of 300 lbs. Air-pumping engines in each boiler room supply air to the furnaces and combustion chambers, while the necessary air for the stoke-hold ventilation is supplied by large fans. Fans are fitted for the engine room and ship ventilation. An electric installation is arranged throughout the vessel on the double-wired system, whilst six powerful searchlights are fitted, two on the forward bridge, two on the shelter deck aft, and one on each mast on a platform of great elevation. The vessel will have three funnels and two masts. Her complement is about 700 officers and men.

Another of the County class, called the Essex, has just been launched from the government dock yard at Pembroke, but the machinery for this cruiser has been built in the engine shops of John Brown & Co., Ltd., Clydebank works, Glasgow. It consists of two sets of main engines of the four-cylinder triple-expansion type, each of the two sets designed to develop 11,000 I.H.P., giving a combined indicated power of 22,000. Steam is supplied by water tube boilers of the Belleville type. The safety valves on the boilers are loaded to a pressure of 300 lbs. per square inch. The diameters of the high and intermediate pressure cylinders are 37 in. and 60 in. respectively, while the diameter of each of the low pressure cylinders is 69 in., all having a stroke of 42 in. The high and intermediate pressure cylinders are fitted with piston valves of the inside type, having approved adjustable packing rings, while the low pressure cylinders are fitted with treble-ported flat slide valves on their sides, having a

special type of relief frame to relieve them of steam pressure, and the weight of all the valves is suitably balanced in order to reduce the strain on the valve gear as far as possible. The cylinders, which are entirely independent castings, are bolted together to provide sufficient longitudinal stiffeners, and to further increase their stability in the event of ramming, etc., strong struts are fitted between the high pressure cylinder and the forward structure of the vessel, as well as transversely between the respective cylinders in each engine room. The barrels of the high pressure and intermediate pressure cylinders are made of forged steel, and those for the low pressure cylinders of special close-grained cast iron, and are steam jacketed. The valve gear is of double eccentric link-motion type, and is actuated by means of a double-cylinder engine attached to one of the intermediate front columns at the level of the starting platform and beside the starting handles. Each of the reversing levers is provided with screw gear, so that the valves of each cylinder may be linked up independently. The pistons, cylinder covers, and steam chest doors are of cast steel, the piston and connecting rods are of Siemens-Martin steel, and metallic packing has been employed for all stuffing box glands of the piston rods and valve spindles of the main engines, as well as for all of the auxiliary engines throughout the vessel. The crank shafts are hollow, and each consists of two interchangeable pieces 18 in. in diameter at the journals. The crank arms are cut away as much as possible for lightness and for convenience in fitting the centrifugal lubricators. The thrust shaft and propeller shafting are also hollow, the shafting being 17 in. diameter inboard and 19½ in. diameter outside the ship. The propellers are three-bladed, working inwards, and are 16 ft. 3 in. in diameter; the bosses are of gun metal and the blades are of manganese bronze, this material permitting a considerable reduction of section to be made on account of its very superior strength in comparison with gun metal for such purposes, and consequently a corresponding increase of the efficiency of the propellers is anticipated. The blades are secured to the bosses by large forged naval bronze pins. Tail pieces and guards for preventing eddies either forward or aft of the propeller have been fitted in accordance with the usual admiralty practice. The four main condensers are of cast brass, having a total cooling surface of 23,000 sq. ft. The steam is condensed outside the tubes, which are ⅝ in. in external diameter by .048 in. thick, the circulating water passing through them. The water is supplied by four large Allens' circulating pumps, each driven by an independent engine. The pumps with steam of 200 lbs. pressure are each capable of discharging per hour 1,200 tons of water from the bilge. The engines driving them may exhaust into the atmosphere and work at a speed of 300 revolutions per minute. The exhaust steam from the whole of the auxiliary machinery in the ship is led into the auxiliary exhaust pipes, which are connected with the atmosphere by the auxiliary exhaust pipe carried up the funnel, and also with the low pressure receivers and the respective auxiliary condensers in either engine room. Each of these condensers has its own air and auxiliary circulating pumps entirely independent of those for the main condenser, and are driven by independent engines. The combined cooling surface of these two auxiliary condensers is 3,150 sq. ft., and their tube casings are of rolled brass sheets.

For the Essex are provided in all thirty-one Belleville boilers of the economizer type—eight boilers for the forward room, eleven for the second and twelve for the aft boiler room. The number of elements in the boilers vary, but each element consists of seven pairs of tubes screwed in the usual junction boxes of malleable cast iron. These tubes, 4½ in. in external diameter, are of cold solid-drawn steel, but in the economizer elements there are eight pairs of tubes, and these are 2¾ in. in diameter. The total heating surface of the boilers is 33,100 sq. ft., and in the economizers 17,200 sq. ft., or in all 50,300 sq. ft. The grate area is 1,610 sq. ft., giving a ratio of 31 sq. ft. of heating surface to one of grate area, while the heating surface per unit of power to be developed is 2.29 sq. ft. The main feed pump system consists of three double-acting pumps of the Weir type, one in each boiler room. These pumps draw by independent pipes from the feed tanks and deliver by branch pipes to the feed regulators attached to the boilers. The three pumps of the auxiliary feed system are placed one in each compartment. These auxiliary pumps are also connected to the main feed tanks, and, in addition, have separate connections to the reserve fresh-water tanks, and each discharges to the feed regulators in connection with the boilers. The main steam supply is conveyed by four lines of steel steam pipes, two lines being arranged on each side of the ship, each line entirely independent of the other, as are also the connecting pipes from the boilers to each of the lines. Any boiler may, therefore, be cut off from the system without interfering with the performance of the others in the compartment, as may also any compartment from which one of these main steam pipes lead, without affecting the efficiency of the other compartment. Any group of boilers may supply steam to any of the engines.

The armament of the Bedford, provided by John Brown & Co., Ltd., and Charless Cammell & Co., consists of two twin 6-in. guns in barbettes —one forward and one aft—enclosed in gun house, with specially armored inclined shields. These guns are served through armored trunks from the magazines and shell rooms. The barbette walls are 4 in. thick, and are well supported to the general structure. Four 6-in. guns in casemates on the upper deck, and four 6-in. guns in casemates on the main deck forward and aft, together with the twin guns, give fore-and-aft fire at a high range. Two 6-in. guns in midship casemates on main deck secure a heavy broadside fire. The fronts of the casemates are 4 in. thick hard steel, with the rear plates 2 in. in thickness. Eight 12-pounder 12-cwt. guns and two 12-pounder 8-cwt. field and boat guns are placed at suitable positions, and there is an auxiliary armament of three 3-pounder and eight Maxim guns. At the fore end of the vessel is a steel conning tower of 10 in. thickness, with a communicating tube to protect the gear for controlling operations throughout the ship.

The dimensions of the Essex are similar to those of the Bedford. Both vessels will have a speed of 23 knots, and yet with such great speed both are armored heavily enough to face anything but the heaviest of battleships.

Another event of the week has been the trial trip of the Kumano Maru, the fourteenth mail steamer built on the Clyde within the last five years for the Nippon Yusen Kaisha of Tokio. This vessel was launched by the Fairfield Ship Building & Engineering Co., Ltd., Glasgow, early in June. She was the first to be built at Fairfield for the Nippon Yusen Kaisha, the others having been launched at other yards. The dimensions of the Kumano Maru are: Length over all, 415 ft. 6 in.; breadth, moulded, 48 ft. 6 in.; depth, moulded, 30 ft.; gross tonnage, about 4,800. The vessel, which is of the three-deck type, is built of steel to class A 1 at Lloyd's, with additions to meet the Japanese government rules, and to the British board of trade regulations for passenger certificate. The hull is divided into water-tight compartments by eight steel bulkheads, and the double bottom is closely subdivided by water-tight floors and girders, so that risks from collision or grounding are reduced to a minimum. The accommodation for first-class passengers is of the very highest type. The state rooms are arranged on the upper deck amidships, and the dining saloon, social hall and smoking rooms on the bridge deck. Second-class accommodation is provided under the poop, with a smoking room in the house on the deck above. Steerage berths are fitted for a limited number of passengers in the forward and after compartments on the main deck. A special feature of the vessel is the ventilation and heating and cooling of the cabins, which is on an elaborate scale. The propelling machinery consists of one set of triple-expansion surface-condensing engines, having three inverted cylinders working on three cranks. The high pressure cylinder is 31 in. diameter, the intermediate 51 in., and the low pressure 85 in., all adapted for a stroke of 4 ft. 6 in. Steam is supplied by three double-ended and two single-ended boilers, made entirely of steel and all working at a pressure of 185 lbs.

An interesting vessel has just been launched at Leith by Messrs. Ramage & Ferguson, Ltd., namely, a steel screw cargo and passenger steamer for the Borneo Co., Ltd., for their trade between Singapore and Sarawak. This vessel is 230 ft. length by 34 ft. breadth, by 15 ft. 10 in. moulded depth. The machinery consists of triple-expansion engines, with cylinders 19, 31 and 50 in. diameter by 36 in. stroke, steam being supplied from two boilers working at 170 lbs. pressure. The accommodation is arranged on the top of and under the shelter deck for both European and Oriental passengers, and is fitted out for a tropical climate. The vessel is supplied with all the latest deck machinery necessary for quick loading and discharging of cargo. A complete installation of electric light is fitted throughout, and, in addition, the saloons and staterooms are provided with electric ventilating fans. This vessel, which is named Rajah of Sarawak, will load at Leith and sail in a few weeks for Singapore.

Probably the largest fleet of ocean-going cargo and passenger steamers in the world is that owned by the British India Steam Navigation Co., Ltd., a concern of Scottish origin and management, though its headquarters are now in London. All the big fleet of the company has been built on the Clyde. Messrs. A. & J. Inglis, Pointhouse, Glasgow, have just launched the screw steamer Shirala for this company. The dimensions of the vessel are: Length over all, 425 ft.; breadth, 50 ft.; depth, moulded, 30 ft.; with a gross tonnage of 5,500 tons, and a carrying capacity of 8,000 tons. She will be fitted with triple-expansion engines by the builders. She will have accommodation for a limited number of first-class passengers, and will be fitted with electric light and all the latest improvements for the rapid handling of cargo. The British India Steam Navigation Co., Ltd., now owns eighty-one steamers of an aggregate of 182,000 tons, and 80,000 H.P.

Another interesting vessel is the Hop Sang, built by the London & Glasgow Engineering Co., Ltd., Glasgow, for the Indo-China Steam Navigation Co., Ltd. This vessel had her official trial on the Clyde this week. She is 290 ft. long by 42 ft. breadth by 25 ft. moulded depth. She has triple-expansion engines with cylinders 21 in., 34 in. and 36 in. by 42 in. stroke. She is for the coasting trade in the far east.

SHIP BUILDING IN GERMANY.

The British consul-general reports that the remarkable strides made during the past twenty-five years by the ship building industry in Germany have naturally led to the development of numerous other industries which are connected with or dependent upon ship building. This is proved by the fact that not alone is the present aggregate consumption in Germany of iron for ship building purposes about double what it was ten years ago (in 1890 the same is stated to have been 45,000 tons, while in 1900 it is estimated at from 85,000 to 90,000 tons), but that likewise the use of all other materials employed both in the building and equipment of iron steamers and sailing vessels has during the past ten years increased in an equal if not greater degree than that of iron and steel. Ships' fittings, such as capstans, pumps, galleys, skylights, etc., which formerly used to be purchased in the United Kingdom by German ship builders, or if made in Germany itself were very high in price, are now all supplied by German makers, who mostly confine themselves to manufacturing one special kind of article, and who have of late, it is said, begun to do even an export trade in such articles to other countries. Factories of ships' fittings and articles of equipment are now to be found in Hamburg, as well as at Berlin, Hanover, Lubeck, Rostock, and in other North German towns, and all are said to be in a thriving condition. The manufacture of cabin furniture and fittings of all kinds has also made remarkable progress in Germany, as is testified by the fitting up of the large ocean-going steamers which have been built during the last few years in German yards; the furnishing and decoration of the cabins, etc., of some of these vessels, particularly of those recently built by the Hamburg-American line, has been carried out with great artistic taste as well as with an eye to luxurious comfort.

For the construction and repairing of ships there are, besides an establishment belonging to the state where pilot vessels and other craft owned by the government are built and repaired, a number of more or less important ship building yards on the side of the river opposite to Hamburg. In some of these ships of war and ocean-going steamers of the largest class are built, and the most important of these yards now employs about 5,000 workmen. There are several dry docks, amongst which is a floating dry dock for vessels of the largest dimensions, belonging to the building yard companies.

The British vice-consul at Bremen reports that last year was no less profitable for the ship building yards on the Weser than the two previous years. Of the three cruisers building at Bremen city one was completed last year. At Geestemunde and Vegesack altogether thirty-one ships of 35,000 tons were completed, whereas fifteen vessels of 59,300 tons are still building, among them a North German Lloyd steamer of 10,050 tons, the largest ship hitherto launched in that river.

The British vice-consul at Kiel reports great activity in ship building in that vicinity and gives details of extensive orders under way at the Krupp works and the Howaldtswerke, as well as improvements in these establishments.

TRIPLE SCREW SHIPS.

A COMMUNICATION FROM REAR-ADMIRAL GEO. W. MELVILLE, ENGINEER-IN-CHIEF OF THE UNITED STATES NAVY, TRANSLATED FROM MARINE RUNDSCHAU FOR THE JOURNAL OF THE AMERICAN SOCIETY OF NAVAL ENGINEERS.

My attention has recently been called to an article in the Marine Rundschau for March, 1901, which takes as a basis my paper before the Institution of Naval Architects in March, 1899, and then discusses the subject of triple-screw propulsion very thoroughly, going, indeed, at great length into some of the nautical or tactical features which it was not my purpose to discuss. Although the writer simply signs his initials, F. B., thus leaving to conjecture his personality, there can be no doubt that he has given the subject most careful study, and I am glad to express my appreciation of his thorough discussion of the nautical and maneuvering side of the case, which I believe will materially assist in bringing out the benefits to be derived from the use of three screws. Although he mentions my paper as having read it carefully, I find that he does not seem to have grasped clearly some of the points I made; and, while I do not believe in "thrashing over old straw," it may be helpful to all who are studying the question, if these points are restated and further elucidated.

In spite of the fact that I have repeatedly stated otherwise, the idea seems to have considerable currency that three screws were used on the Columbia and Minneapolis for the purpose of securing economy at low speeds by the use of the center screw alone with the wing screws uncoupled. It is true that we did anticipate that there would be this incidental advantage, which experience has shown to have been a mistake with all screws of the same size, but my reason was solely on account of constructive considerations. Further than this, friends of the highest professional standing and greatest experience warned me that the maximum speed would require a greater expenditure of power than if twin screws had been used, and I was prepared to accept this view, as none of us had anything but a priori reasoning to guide us—not an infallible guide by any means.

As I have shown in my paper before the Society of Naval Architects and Marine Engineers, in November, 1894, the trials of the Columbia and Minneapolis, when compared with those of the New York and Olympia, proved conclusively that there was a decided economy of propulsion at full power with the three screws, due to better efficiency of propulsion; that is to say, the ratio of towing power to propelling power was higher in the triple-screw ships than in those having twin screws; or, put inversely, the ratio of propelling power to towing power was lower for the triples than for the twins. For I stated in another paper, previously referred to ("The Logical Arrangements of the Motive Power of Warships," read before the Institution of Naval Architects, March 23, 1899), regarding results from actual trials of large ships as against tank experiments: "The latter serve very well for determining the actual resistance of a hull, but not for fixing the economy of propulsion, or the ratio between the towing and indicated powers. It is in the increase of efficiency, and not in any decrease of resistance, that the economical advantage of triple screws must be found." I am aware that the view was not accepted by all, or, rather, my explanation of it, but the facts are undoubted. Probably no data were ever obtained with more care than in the trials of the four ships named. There was an ample corps of trained observers; the system of observations was the result of many trials; and, what is not always looked after, the indicators had been most carefully calibrated by the same experts in all cases, and the apparent pressures were corrected for the errors of the instruments. There can be no doubt, therefore, of the accuracy of the data.

In the paper of 1894 the comparison of the two systems was made in two ways, according to Froude's law, and also by an approximate computation of the hull resistance. Somewhat to my own surprise, the two methods gave almost identical results. In the discussion, the author of the book from which I had taken the data and formulæ for computing the hull resistance, claimed that I had not used the proper coefficients because the hulls were not alike, and gave a new formula, apparently invented for the occasion, which he said "he had found better adapted to such cases." As these were the first cases of just the kind, the suspicion of special invention is very strong, especially as the formula was so arranged as to give the ship's length a very undue inverse weight in calculating wave-making resistance. With this special formula, assisted by some errors of computation, the efficiencies were reversed and made to appear as if the twin screw ships were the more efficient. However, no question was raised as to the comparison by Froude's method, which is, of course, the more accurate, and is, in fact, the same that is now used in predicting results from model experiments and in comparing such experiments. I may add that the special formula, when applied to large and fast liners, which compared about as the hulls of the two sets of naval vessels, gave absurd results, proving still further that it was invented simply as an attempt to discredit the remarkable results of the triple-screw ships. I have been told that model experiments have shown that there is no gain from three screws, but I do not believe that model experiments on screws have yet attained any such authoritative acceptance as to discredit actual trials. The fact is, of course, that no strictly comparative experiments of the two systems have yet been made; that is, there has not yet been a case of the building of two ships with identical hulls for the same speed, and differing only in having one driven by twin and the other by triple screws. Nor have the experiments with either the Kaiserin Augusta or the Minneapolis been such as to make a crucial test, at full power, of the merits of the two systems. The comparable experiments on the Augusta were at such low powers that cylinder condensation alone with three engines would more than neutralize any gain in propelling efficiency. Indeed, I think it surprising that the three engines made such a good showing when developing about one-fourteenth of full power.

The experiments with the Kaiserin Augusta are, however, of the highest value, and they call attention in a marked way to a great advantage of the system of a large central engine and small wing engines, proposed in my paper of 1899. In all cases where the center screw was used alone, the wing screws being uncoupled, the slip was abnormal, running from 31 to 39 per cent. Now, in well-designed machinery this can mean only one thing—that the central propeller, under these circumstances, was too small, that is, of inadequate surface. This is really obvious at a glance, but will be still more evident if we compute the indicated thrust. Now, when the center screw is designed to make the thrust of half of full power and the wing screws each one-fourth, we not only have 17 per cent greater area to take the thrust, but on account of having reduced the idle screws, we have reduced the resistance, so that we have less thrust on the larger screw. This will reduce the slip to normal proportions and will, I am sure, give us the economy which was originally anticipated, although unadvisedly, from the use of the center screw alone. It must be remembered that the anticipated economy of steam has been realized, but the radius of action was not increased on account of the increased resistance due to the wing screws and the abnormal slip due to the inadequate size of the center screw when working alone. The economy of steam was very clearly demonstrated in some experiments made in 1896 by my direction on the U. S. S. San Francisco in the Mediterranean. She is a twin-screw ship, and the trials were with one and two screws, each lasting for 48 hours, and at about the same speed of the ship. When working with one screw the indicated horse power was 873, revolutions 65, and coal per indicated horse power 2.91 lbs. With two screws the indicated horse power was only 766, the revolutions 52, and the coal per indicated horse power 3.45 lbs. The helm angle when using one screw was 9°, I believe; therefore, we are entitled from all the available data to conclude that with the plan proposed in my paper of 1899 we should not only get the increased steam economy—of that we are certain—but that this would not be offset, as in the case of propellers of equal size, by the increased resistance when dragging. In my paper of 1899 I pointed out the advantage of the large central screw, but discussed it in a somewhat different way. A further advantage of this arrangement and proportion of the propellers is that we can, with this system, use the wing screws with almost the same steam economy as the central screw. The combined power of their engines is the same as that of the center engine, and there is only the increased surface of the cylinders to cause any reductions of steam economy. Where the propellers were all of the same size the center one was too small, and the use of the two wing engines for low speeds gave very unfavorable conditions for steam economy. In the new system we shall have the same adequate propelling surface, either with the wing screws or with the center screw alone, and in either case our reduced power is a fraction of only half the total power, instead of two-thirds, as in the case of the wing screws, where all are alike.

"F. B.," in stating the disadvantages of triple screws, speaks of the increased complexity and greater length required in the ship. It is perfectly evident that he referred to ships with cylindrical boilers, all forward of the engines. In my paper of '99, it is shown that the engines occupy no greater length in the ship than would those driving twin screws, and, indeed, that space is much better utilized, as the small wing engines are right alongside of the central engine, this being possible on account of their shorter stroke. It is also pointed out that this permits the location of the engines where the effects of vibration will be a minimum. It also enables a better trim of the vessel to be obtained by putting part of the boilers abaft the engines. This meets the objection raised with respect to the location of the after turret. With respect to the matter of alleged increased complexity of piping and auxiliaries, attention may be called to the fact that multiplication does not necessarily mean complication. Experience has shown that it is just as easy for a man to handle twin-screw machinery as it formerly was to handle that for one screw, and the experience on the Columbia and Minneapolis has been the same with three screws. Indeed, this is simply one case of what all recent experience has shown with all kinds of machinery. Along with the increased amount of machinery have come facilties for readier manipulation and increased knowledge, and also our own increased ability, so that it is really an easier matter now to have thorough control of even triple screws than it was twenty years ago for a single screw. The people who may find the triple-screw system complicated are the deck officers, but they have now such aids in the shape of annunciators, shaft and speed indicators, voice tubes, etc., that a very short experience renders them thoroughly au fait. Each engine room and fire room has its own crew, who have no more bother than in a single-screw ship. As for the piping, there is more of it, with more valves, but there are more mechanics to keep things in order. It must be remembered, too, that there is an increase of safety in the smaller pipes. The use of what we call "manifolds" in the piping system, which in a way are analogous to the busbars of an electric switchboard, greatly simplifies what might otherwise be very complex.

In connection with this allegation of increased complication I may refer to the matter of auxiliaries, of which special mention has been made. As far as their care and manipulation are concerned, the increase in the working force takes care of that. With respect to economy, it is to be noted that as the main engines will be operating at a higher percentage of full power, so will the auxiliaries, with better steam economy as a consequence. It is also to be noted that we can, in effect, make them a part of the main engine by taking steam from one receiver and exhausing into another, thereby getting practically the same economy as the main engines; or we can exhaust into one of the feed heaters with consequent economy. The plain facts are that hardly any objections from an engineering standpoint can be asserted that will bear serious investigation, and least of all this one of complication. When the Blake and the Blenheim of the British, and the New York and the Brooklyn of the United States navy, were brought out with four sets of engines, which is worse, of course, if complication really is so objectionable, not a word was said about complication, even where such a plan was used, as in the British ships, of disconnecting all the connecting rods of the idle engines. The American system used a clutch coupling between the two sets of engines.

From an engineering standpoint the system of half the power in a central engine and one quarter power in each wing engine has the following, among other great advantages, for war vessels: Increased economy at full power; increased economy at reduced power; readiness for changing to full power when working at reduced powers; reduced engine-room space. Further than this, the central screw is of adequate size to get all the benefits derivable from using a single engine at reduced powers; vibration is minimized: and we have two independent plants, each capable of economical propulsion up to three-fourths speed.

The many advantages of the triple-screw system are well set out by

"F. B.," but I want to emphasize the one relating to the decreased liability to accident to the propellers on account of decreased size, and to point out that the scheme in the '99 paper carries this to the fullest extent by using wing screws of the least practicable diameter. This advantage in the case of ramming I believe to be real, but, as yet, we can only discuss this a priori. We have, however, had a great deal of practical experience with damage due to striking docks, etc. When the Olympia was coming home through the Suez canal one of her screws came in contact with the bank—not the bottom—and was bent so that the rest of the trip had to be made with one screw. Again, a number of our torpedo boats were sent on a trip involving the passage of two canals. Nearly every one had her screws damaged by striking the sides of the locks or of the banks, on account of the protruding twin screws of relatively large diameter.

As an explanation of the amount I have written about triple screws, I may point out, as I have done before, that I am not urging the adoption of a scheme originated by me. I can hardly be called a convert, for I have never opposed them, but I am really a follower, as far as the principle is concerned. The only credit I can claim is the courage of my convictions in using them for a much larger power than had been attempted up to the time they were used in the Columbia and Minneapolis. My interest is, however, now to assist in the campaign of education, which will, I firmly believe, result in their general adoption. To a certain extent, I feel the natural desire of every pioneer to have his work approved. So far as the design of our own triple-screw ships is concerned, they exceeded what we demanded and expected of them, and are, indeed, an unqualified success. The fact that they have not as yet been repeated in the American navy, and a certain amount of sneering criticism at certain features, have made me feel that there is ample justification for bringing the subject repeatedly before engineers and naval men generally, and discussing the subject from various aspects in the effort to secure complete elucidation and agreement of opinion. As in the case of all new problems, our first attempts at solution are apt to be only partially successful covering the main points, but missing some which, while subsidiary, are still of real importance. One of these points is the question of economy at low powers, of which I believe to have reached a reasonable solution in the use of a large central engine and two small wing engines. Some of the disadvantages enumerated are real, but can be obviated; others are largely fanciful, based on insufficient acquaintance with the details of machinery. What I am urging is to give this system, like all promising innovations, a fair and sympathetic test. When it has proved that it has advantages of great weight—and of this there is no doubt—we should take the next logical step, namely, to repeat with such modifications as are suggested by experience with a view to removing disadvantages. To take the attitude of unwillingness to make further tests on such weak grounds as "increased complication," is to put ourselves back more than a hundred years, and is utterly unworthy of the scientific spirit of the twentieth century.

TUNNEL BETWEEN GREAT BRITAIN AND IRELAND.

A subject of exceeding interest is the proposed tunnel between Scotland and Ireland, and it was upon this topic that Mr. James Barton read a paper before the International Engineering Congress at Glasgow. He did not touch upon the important advantage of the tunnel but discussed it simply from the professional standpoint. He divided it into several parts, beginning with the selection of site. He said:

The first question considered is the selection of a site for the tunnel. Three positions suggest themselves. First, the nearest approach of Great Britain to Ireland is at the Mull of Cantyre, where the distance to the County Antrim is 12½ miles. The next position in point of distance is from Wigtonshire, where the Scotch coast comes within 21 to 25 miles of Ireland. The third position is from Holyhead to Howth. The maximum depth of water on the Cantyre route is 460 ft.; on the Wigtonshire route the depth varies according to the line selected, and is from 480 ft. to 900 ft.; and the greatest depth on the Holyhead route is 432 ft. The strata of the Cantyre route are lower silurian; on the Wigtonshire route to Antrim, silurian for the most part, but overlaid near the Irish coast by new red sandstone and the Keuper marls; between Wigtonshire and the County Down, lower silurian throughout; from North Wales to Dublin would be in the Cambrian rocks.

The first of these positions has to be abandoned on account of its not forming a practically useful connection. The second forms a direct line between Carlisle and Belfast, the business center of Ireland, and gives the best route from Scotland to all Ireland, and for the north of England to Ireland. The third route would connect London best with Dublin, but would be of little use as between Scotland and Ireland, and being more than double the length of the second route, it has to be abandoned, and the second route adopted for the present project. On this second route two lines are considered—one from Portpatrick, Wigtonshire, to Donaghadee, County Down, and the other from near Corsewall light to the County Antrim, with a curve in the center to pass round the north end of the Beaufort dyke, a deep valley or gorge in the bottom of the sea, which runs for 30 miles north and south 7 miles from the Scotch coast. The channel bed north of this dyke is comparatively level. A tunnel under Beaufort dyke would involve very serious difficulties and probably dangers.

The tunnel line adopted begins at the Stranraer railway station, and passing north, enters the tunnel at 5 miles, and descending one in seventy-five, passes under the shore line at the Ebbstone Beacon at 9 miles; it passes round a curve of a mile radius at the head of Beaufort dyke at 16 miles, and reaches the shore line at Island Magee, County Antrim, at 34 miles, rising one in seventy-five from the deep water, and passing out of the tunnel at 39½ miles, it joins the Belfast & Northern Counties Railway at 41 miles, and runs 10½ miles along it into the terminus at Belfast. Total length, Stranraer to Belfast, 51½ miles, of which 34½ miles is tunnel, and 25 miles of this under the sea.

To provide suitable drainage the line falls each way from the center, and drainage headings have to be run to the shafts at each side, where pumping stations would be placed. Subsidiary shafts are proposed at a short distance inland, and would, in connection with the main shafts, enable specially accurate lines to be given for the tunnel. The geological formations have been reported on by Prof. Hull, late director of the geological government survey of Ireland. His views were confirmed by the late Mr. Topley of the geological survey of London.

The top of the tunnel is proposed to be placed 150 ft. below sea bottom, and the tunnel is to be for a double line. The principal operation, and that which controls the time of execution of the whole work, is the heading. The heading proposed is 10 ft. wide by 7 ft. high. The heading through the silurian, we think, should be as rapid as those now being made in the Simplon tunnel; those in the Keuper marls more rapid; and the whole heading can, we believe, be completed under ten years, and the finished tunnel between eleven and twelve. Improvements in rock drilling in the Alpine tunnels have been remarkable of late years; the maximum speeds of Alpine tunnels are as follows:

	Cost of tunnel per yard complete.
Mont Cenis, maximum speed per day, 6 yards	£224
St. Gothard, maximum speed per day, 10 yards	£142
Arlberg, maximum speed per day, 12 yards	£107

The Simplon heading has so far been faster than the Arlberg, and in a very hard rock. The amount of water to be dealt with is the one uncertainty, though we have grounds for believing it is not likely to be a very serious difficulty. The Severn and Mersey tunnels encountered no serious water leakage under the sea, the great leak of the Severn tunnel being from fresh water and a quarter of a mile from the sea. Judging from these tunnels, and a tunnel driven under the Forth by Sir Benjamin Baker, there seems good ground for believing that the sea bed under the Irish channel has probably sealed all interstices, so that excavation may be expected to be fairly dry. Silurian rocks are found in beds nearly vertical, which have been under heavy horizontal pressure, and will probably give little water either in the under-sea or approach tunnels; the Keuper marls under the Irish side are remarkably suited to an underwater tunnel, being perfectly water-tight where examined down to 900 ft.

The new red sandstone which lies between the marl and silurian allows water to percolate, but is not likely to give a large quantity; 150 ft. of cover between tunnel and sea bed will, it is expected, make all safe. The working of the line from Stranraer to Belfast is proposed to be by electric motors from installations near the main shafts, one at each side of the channel; and it is intended that trains be run at a speed of 60 to 70 miles an hour, so that the time in tunnel would be a little over half an hour, and the whole distance traversed (Stranraer to Belfast) under an hour.

The ventilation of the tunnel is rendered easy by the use of electric power. A current of fresh air would be sent in by a fan at one end, and drawn out at the other, probably upon the Saccardo system, successfully used in Italy.

The cost of the tunnel is estimated by the engineers and by a contractor at £10,000,000, exclusive of interest during construction, and this leaves a considerable margin for contingencies. The finance of the project is the present difficulty, the prospect as a speculation not being sufficiently good. The subject has been brought before the government as an imperial one, and a small guarantee asked. Mr. Balfour expressed himself desirous of seeing the project carried out, and was willing, if the amount of capital could be definitely fixed, to bring the subject before his colleagues. Until a head has been run from the Irish side past the junction between the sandstone and silurian, no contractor is willing to undertake the tunnel at a fixed sum. To do this, however, would probably not cost more than £500,000, and a heading through the whole 34 miles is estimated at £2,500,000.

ICE CRUSHER FOR STRAITS OF CANSO.

A very interesting type of vessel, built by Sir W. G. Armstrong, Whitworth & Co., Ltd., Walker, England, to the order of the minister of railways and canals, Canada, for the carriage of railway trains across the Straits of Canso to and from Port Mulgrave in Nova Scotia, ran her official trials recently. The vessel, named the Scotia, is also constructed to serve as an ice breaker, as during a considerable portion of the winter months the straits become congested with large masses of ice that drift in with the tides and winds. The steamer is capable of taking over a load of nine Pullman cars, 84 ft. 6 in. long each, or a correspondingly large number of box goods cars. She is also specially strengthened to take over an express locomotive and tender weighing not less than 118 tons. The vessel was tried on the measured mile with equivalent weights to her working load on board, when she proved herself able to easily maintain her contract speed, and developed the power necessary for ice-breaking. The Scotia has been fitted by the Wallsend Slipway & Engineering Co., Ltd., with two sets of triple-expansion engines of 1,200 H.P. each, with four large cylindrical boilers, all working at a pressure of 160 lbs., and the shafting is continuous from end to end of the vessel. There is an ice breaking propeller at each end of the vessel, and she has also rudders at each end, which admit of the ship being handled in either direction at will.

The Westinghouse Church Kent Co. has been awarded a contract by the Eastern Ship Building Co. of New London, Conn., to furnish eight 90-K. W. direct-connected 110-volt generating sets for the two mammoth vessels building for the Great Northern Steamship Co. The Westinghouse Electric Mfg. Co.'s dynamos will be used and an efficiency of 92 per cent. is guaranteed. The sets will run at 300 revolutions with 150 lbs. of steam, and this installation is the largest ever put into any vessel. The engines have to show a water consumption of 19.5 lbs. per indicated horse power per hour or they will not be accepted. The Westinghouse company will also furnish the induced draft blowers for the Great Northern steamships. These fans are eight in number and are 16 ft. by 14 ft. over all, running at 350 revolutions, operated by Westinghouse engines, which must show an economy of 20 lbs. of steam per horse power before acceptance. The value of these two contracts is said to be about $100,000. W. Blackburn Smith of Perth Amboy, N. J., is to furnish eight feed water filters for these steamships. These filters are of the Rankine type and to each have a capacity of 6,000 I. H. P.

Charles W. Morse of New York has bought the Boston & Bangor line of steamships. Mr. Morse already controls the Boston & Kennebec line and he is also negotiating for the Boston & Bar Harbor line so that the Boston steamships can have additional wharf facilities.

ENGINEERING IN THE BRITISH NAVY.

From the Engineer, London.

There are periodical visitations of an engineering character which occupy the public mind, due chiefly to the prominence given to the matter for the time being in the house of commons and the press. Such was the case some fifteen years ago when the proposal to substitute the triple expansion for the compound engine then in vogue was submitted. Today the problem of the water tube boiler is the theme that is attracting the attention, not only of professional engineers, but of that great multitude who read the daily papers. When it is considered what vast strides in importance machinery has taken within the last few years, whether it be in the manufacture of bicycles, agricultural machinery, or marine engines, it will be readily understood how enlarged are the ranks of engineers in all the innumerable pursuits classified under this heading. But it must not be supposed that because an engineer does not happen to work on one particular kind of machinery that he is ignorant of that machinery. Sir Joseph Whitworth once remarked, that practice varies, but principles are eternal. Little wonder, then, is it that the subject of naval machinery and boilers is receiving so much attention; and that the majority of the public are now not misled by the articles which appear frequently in our morning and evening papers, many of them purporting to be written by "naval experts," which show lamentable lack of knowledge on the part of the writers. The title "naval expert" is somewhat analogous to that of professor as used by palmists, quack-doctors, and kindred gentlemen, inasmuch as it is self-conferred. The object of this article will be to present to its readers the true position of machinery and those employed in working and tending it on board our men-of-war.

To fully appreciate the condition of things today we must go back to the past a little. About 1840 the admiralty decided on introducing steam into the navy, purely as an auxiliary to sail; and this view of its utility was held by the board of admiralty till about twenty years ago, when some ships were built without any sails whatever. Naturally, as steam was of such minor importance, the men in charge of it held no position on board ship; and this state of affairs remained constant for years, in spite of the growth of machinery in every succeeding vessel, and now, even when everything on board a man-of-war is done by engines, the old conditions prevail to a very great extent. It is impossible for anybody to read the history of steam in the British navy without being struck by the opposition with which it has always been met by the admiralty and the executive officer. It has been, and still is, a question of keeping the whole department subordinate, cutting the weight of machinery down to dangerous limits, and at the same time exacting the maximum amount of work from it, while the engineers in every ship in the navy are handicapped by the interference of the executive officers. The amount of this interference varies with the ship, but in all it exists. As proof that the admiralty insist on the executive officer always having control they appointed an admiral president of the committee on water tube boilers, with a commander as one of the secretaries, although I can state that neither of these officers would have previously been able to have distinguished between the various types of boilers on which they were going to report.

This cutting down of all concerning the machinery, due to the prejudice and ignorance of the subject of the board of admiralty, which is another name for four admirals, has led to the adoption of machinery which every engineer knows is most untrustworthy. The point urged is that weight and space are of primary importance in a ship of war, whereas in merchant vessels there is no such limitation. This is drilled into the head of the young naval engineer as soon as he enters college, and is repeated in all text-books and papers bearing on the subject. Though I have searched and inquired I have never yet found out why. Surely a private ship owner is as anxious to save space for his passengers and cargo, and thus save initial cost and subsequent dock dues, etc., as an admiralty naval architect is for his guns and stores. But this desire for lightness and compactness utterly vanishes when relating to matters connected with the ship's hull, especially if it concerns the senior executive officers or affects the ship's appearance. Anybody who, with any mechanical knowledge, has ever looked at such fittings as dead lights for scuttles, brass handrails, brackets for electric lamps, clips for watertight doors, etc., will readily appreciate the truth of the foregoing remarks. On one occasion about six years ago, when the channel squadron visited the north-east ports, a mechanical engineer from Leeds was looking over one of the battleships, and asked what a certain valve was for, and on being told that it was for ventilation purposes, remarked that it was strong enough to stand a pressure of 1000 lbs. per square inch. The brass name plate fastened to each bulkhead to designate its number contain twice as much metal as the bearings of some of the most important auxiliary engines in the ship, the breakdown of which would mean the crippling of the vessel in speed. The natural question is, Why does such a state of things exist? The answer is not difficult. The admiralty, that is the elderly gentlemen who control naval affairs, have been in ships—most of them sailing vessels—all their lives, and to a certain extent understand something of the requirements of the ship builder. The naval architects are civilians, with a gentleman at the head of their affairs who occupies the dual position of chief naval architect and assistant comptroller of the navy. Consequently his voice carries weight with the board of admiralty, and it would be monstrous to expect him to attend to the needs of another department which would frequently involve the curtailing of his own requirements. The first thing is to produce a ship on paper, of a certain displacement, carrying so many guns, so many men, and with a given trial trip speed. This latter fallacy will be referred to later.

Now turn to the engineer-in-chief of the navy. He is always a naval man, is under the naval discipline act, has no seat on the board of admiralty, and is given by the ship designer so much space in which to place machinery capable of driving the ship at a given speed. The weight he is allowed is likewise fixed. Further, if he does not meet the wishes of the board he can be sent to sea at any time. Contrast this with the position of the chief engineer of a private ship building concern. Here he takes what space and weight he requires to get the required speed, and the ship designer utilizes the remainder for passenger accommodation, cargo, etc. Of course there must be frequently concessions granted on either side; but in the navy they are all one way. The consequences are the introduction into ships of war of very light engines, running at abnormal speeds, which require constant human supervision whilst under way, and continual repair when stopped, due to the excessive wear and tear inseparable from the design. The private ship owners know full well that if they were to supply their ships with the same kind of engines mail contracts would soon be lost, besides passengers fighting shy of untrustworthy vessels. But your naval expert will say "you cannot compare men-of-war and merchant ships." Unhappily you cannot; but the reason why you should not be able to do so is not so apparent. A fleet engineer of the royal navy, to whom I once spoke to about the lack of space in the engine-rooms of a battleship then building on the Clyde, which this gentleman was superintending, remarked, "The old story, trying to put a quart measure into a pint pot."

Another accepted axiom is that the engines of all ships of war must be below the water line, because as a shot only penetrates a few inches under water and then ricochets, the machinery is protected from the enemy's fire. Consequently, as the engines are so low, the speed has to be increased to obtain the required horse power, and the wear and tear of all working surfaces is greatly augmented with the corresponding liability to failure. Taken roughly, the number of revolutions in a man-of-war in a given time is about one and a half times that of an Atlantic liner for the same speed. No effort is made to decrease this speed of engine by increasing the height; in fact, on the contrary, in modern ships the evil is aggravated. No supporter, however staunch to the admiralty's present policy, could claim that hot bearings and big defect lists are uncommon in recent vessels. There is apparently no reason why vertical side armor should not be carried higher than at present round the top of the engines, when the risk of its penetration by an enemy's fire would be small as compared to the chances of breakdown or inability to keep the designed speed and probable capture. John Stuart Mill says that if you start with a wrong premise all your subsequent deductions will be wrong. So with the admiralty. They try to overcome inherent defects by improvement in mechanical details.

Although the admiralty fixes the principal dimensions and proportions of all the machinery for the navy, they very wisely leave it to the ingenuity of the private manufacturers of engines to carry their ideas into effect. It is not too much to say that nearly all the improvements in naval machinery have been suggested by the great outside engineers who execute admiralty work. The only drawback to the system is that the public is misled by the results, not knowing how they are obtained. I refer to the trials of engines and boilers which are duly chronicled in the press with much pride. Take, as an example, a battleship which has just recently completed her trials. Besides about forty skilled men in the employ of the contractors, most of whom had previously been engaged putting the engines into the ship, and were, consequently, acquainted with them, there were lent for the trials thirty-seven chief stokers; sixteen leading stokers, first-class; five leading stokers, second-class; and 199 stokers. Beyond this there were contractors' managers, admiralty representatives, and an army of men from the dock yard. Now contrast this with her complement when commissioned and ready for action—six engineers, nine artificers, six chief stokers, twelve leading stokers, first-class; six leading stokers, second-class; and 108 stokers; quite fifty of the latter being second-class men who do not know a boiler from a condenser. So with one assistant engineer on watch, together with two artificers, one chief stoker, three leading stokers, and about thirty stokers, the same results are expected as on the trials. No modern ship can possibly steam at anything like her full speed without considerable assistance from the upper deck, when the "handy man" trims the coal for the stokers to throw on the fires. But this is all very well in peace time when the only object is to get a satisfactory trial report to the admiralty; but what is going to happen in war time when the "handy man" is standing behind his gun, and is not available for coal trimming?

Another proof, if proof were needed, of the esteem in which the admiralty holds engineering, is to be found in the destroyers employed in instructional work. These boats, which are of the flimsiest construction, run for three weeks out of the month, one week of which is at full speed. Into these vessels, lately, have been introduced artificer engineers, in spite of every conceivable article on board being in the engineer's charge, and the engines developing between 4,000 and 5,000 H. P. This is about equivalent to the power of most of the liners running to Australia and the east, which usually carry a complement of six or seven engineers. Thus, in the navy one man does the work that six do outside, and although artificer engineers are most excellent men, they cannot be expected to do the work of highly trained and scientific engineers. It is so throughout the service. The engine rooms are starved, but a reference to the navy list will prove that, in all cases, the upper deck officers are fully represented.

The average man, when he thinks of the engineer, imagines him only to be a person who propels the ship through the water. Here is a short list of his other responsibilities: Lighting the ship with electricity; the care and maintenance of all gun machinery, which in a battleship is not inconsiderable; the manufacture of fresh from salt water, and in hot weather the icing of the same; the maintenance of all torpedoes with repairs after they have been fired by the "handy men," together with all the air compressing machinery for charging them; steering machinery, capstan machinery, the skin of the ship, and, in short, a list that would nearly fill a page. The engineer bears the same relationship to the executive and the other officers that the watchmaker does to the man who winds up his watch every night. As soon as it gets out of order take it back to the watchmaker; the only difference being that the watchmaker does his work unmolested by outside interference.

To revert now to the machinery. The boilers are the heart of a steamer. It is they that supply the steam which drives the engines. Until quite recently—1894—the admiralty practice was to fit the cylindrical fire tube or Scotch boiler working at a pressure of 155 lbs. per square inch. Long before this there were some merchant vessels working at 200 lbs. and above with the same class of boilers, and why the admiralty never for years increased this pressure is a mystery. The answer is again as before —weight. The thickness of all parts of a boiler has naturally to be increased with the pressure, which adds to the weight. This is more pronounced in a Scotch boiler than in one of the water tube species. Water tube boilers are divided into two classes. First we have the small tube variety with straight or bent tubes of about an inch in diameter, connecting water pockets at the bottom to a steam

drum at the top. This type has been fitted in the royal navy to all destroyers, and to many gunboats and small cruisers. The Yarrow, Thornycroft, Reed and Normand are perhaps the best known, and the principal difference in them is the curvature of the tubes. Then there is the big tube type, with tubes of from 3 in. to 4½ in. in diameter, connecting a bottom water tube with a steam drum at the top, but the tubes in this case lying in a horizontal plane. This type includes the Belleville, Niclausse and Babcock & Wilcox, and is intended to serve in big vessels and for long periods of steaming. The small tube boiler first came to life about twenty-five years ago, owing to the demand then for higher speeds in torpedo boats. It is a very light boiler, which can be forced to an extent that other steam generators cannot. It has practically enabled the modern torpedo boat destroyers to attain their great speeds; but the life of the boiler is very short, the repairs required very great, and the skill in handling very considerable. These sacrifices are only what can be expected from a boiler designed to drive such frail craft as destroyers. Their average life is about two or three years; but there are several new boats lying in the dock yard reserves that have had to have their boilers retubed in spite of only having recently been built, and never having steamed except on their trials. This is due to the decay that goes on inside the tube whilst the boilers are idle, and as the tubes are very thin, they, consequently, cannot afford to lose very much in thickness. Taken altogether they are costly and untrustworthy boilers; but they enable ships to get very high trial trip speeds, and afterwards to find plenty of employment for the dock yards. These boilers have been fitted in many large vessels in foreign navies, but have not been considered sufficiently good for this purpose by the British admiralty. Turning now to the big tube type—which is the boiler that has of late been the subject of so much controversy—we find that it has been universally adopted by the admiralty for all ships designed since 1894, excepting the small vessels with "express" boilers, referred to earlier in this article. The history of these boilers in the British navy is briefly this: In 1892 the admiralty, always on the lookout to cut down weight, fitted eight Belleville boilers to the torpedo gunboat Sharpshooter, which had previously given a lot of trouble, not so much with her boilers, which were of the modified locomotive type, as with her engines, which were so light as to be unequal to their work. These Belleville boilers worked at 150 lbs. per square inch. After a series of trials at low powers in the channel, which were kept very secret, the admiralty ordered this type of boiler for the Terrible and Powerful, but increased the pressure to 260 lbs. Finding the coal consumption of these French innovations very high, the admiralty hit on the plan of fitting a feed-water heater on top of the boilers to catch some of the escaping gases, which they called economizers. These were first fitted to the Diadem in 1895, in which the pressure had been increased to 300 lbs. per square inch. Everybody who knows anything about physics or engineering is aware of the considerable economy effected by using high pressure steam and expanding it down to a low pressure. But it never seemed to occur to the engineering officials at the admiralty that the major part of a man-of-war's time is spent in harbor, where the only engines needed are a dynamo for illuminating purposes, a circulating and air-pump engine to condense and remove the exhaust steam, and a bilge pump. These machines require probably about 30 lbs. of steam to drive them, with the exception of the dynamo, which needs about 80 lbs. Consequently, where is the gain in using 300 lbs. if you only require 80 lbs.? The admiralty was forced to seek a subterfuge, and to employ the high pressure and exhaust the steam at a correspondingly high rate. For example, instead of using 80 lbs. to drive the dynamo and exhausting at no pressure, they use 140 lbs. and exhaust at 60 lbs.. The wear and tear of all parts is considerably increased and it is admitted by all who have sailed with this clumsy arrangement that the leakage from joints, not to speak of the extra work on the engineering staff, far outstrip any theoretical gain. So in two of the points which the admiralty prided themselves on benefiting by the introduction of water tube boilers, namely, coal consumption, which is a very important factor in the question of weight of machinery and economy of steam, experience has not fulfilled their anticipations. Like their brethren of the small tube type, these boilers are very short lived—the engineer-in-chief of the navy considers about six years, but none of them in the English service have as yet lasted so long. A number of sloops have recently been built for service in foreign waters, far removed from any of the dock yards where repairs can be effected, yet the admiralty, pledged to its policy, felt bound to fit water tube boilers to these vessels, the maximum speed of which is only 13½ knots, and for this they require 300 lbs. pressure and 180 revolutions. Sixty revolutions and 100 lbs. pressure a few years ago would have sufficed to obtain this speed, and the ships would have lasted double the time and cost much less in repair and upkeep.

In spite of all the talk of "improved" machinery of modern vessels, speeds have remained nearly constant in big ships, and particularly cruisers, for the last ten years. There are few naval officers who will not agree that in a long run the Edgars and Blenheims of ten years ago would not be last in a race with the Diadems and Cressys, and would be much more certain of finishing than their modern rivals. Improvement with regard to naval machinery means increased complexity and trouble to those who have to work it.

Last summer the then first lord of the admiralty appointed a committee of one naval and four private engineers to consider the question of water tube boilers for ships of war. This policy was dictated by frequent breakdowns of ships fitted with them, and the comments of the press and public on the matter. But the committee was not appointed till all modern ships had been so fitted, representing some £50,000,000 sterling. However, better late than never. They have recently published an ad interim report in which water tube boilers are advocated, but the Belleville type condemned. As the report is only ad interim, and, as the committee are still seeking evidence with regard to which type of boiler is the best for naval purposes, it is only proposed to investigate the reasons advanced for advocating the adoption of water tube boilers at all. The reasons given are: (a) Rapidity of raising steam and of increasing the number of boilers at work; (b) reduction to a minimum of danger to the ship from damage to boilers from shot or shell; (c) possibility of removing damaged boilers and replacing them by new boilers in a very short time, and without opening up the decks or removing fixtures of the hull.

The first reason (a) of quick steam-raising is one which has all along been urged by water tube boiler enthusiasts to be one of their strong characteristics. But the importance of this matter may be easily exaggerated. A Belleville boiler takes about two hours to get steam from cold water, and a Scotch about four. These times may be considerably reduced if necessary by forcing the fires; but the penalty is leaky joints, together with collapse of brickwork in the Belleville, due to the "bumping" of the water when on the point of ebullition. No more damage is done to a Scotch than to a water tube boiler by forcing it, and on one occasion of emergency I raised steam from cold water to 100 lbs. in three hours in the largest class of double-ended boilers fitted in the navy without any visible harm. The trials of the Minerva and Highflyer proved the truth of these remarks. Granted, then, that the water tube boilers can raise steam in half an hour in an extreme case, what is the good of having steam in your boiler if you cannot move your engines? The large engines now fitted to big ships take at least two hours warming up before they are ready to move; otherwise there is grave risk of breaking something, due to water forming in the cylinders. But what ship in war time is going to be lying with her boilers not alight, and if the fires are banked then the Scotch has just as much advantage as any water tube boiler.

The second reason (b) appears somewhat problematical. It means that a ship being supplied with a great number of water tube boilers, the loss of one or two of these small units makes no difference to the speed of the ship compared with the loss of one large Scotch boiler, of which there are only a few fitted in the ship. But all boilers in the navy are below the water line, and placed beneath an armored deck, and should shot or shell get into these regions it will not very much matter what class of boilers is supplied. No man would care to stop, even if he could, after the bursting of one water tube boiler to see whether the remainder went or not, and as everything depends upon human attention this feature of the water tube boiler does not appear of so much importance.

The third reason (c) resolves itself into a question of expense. If a boiler is sufficiently damaged to require replacing by a new one, it will become too big a job for the ship's staff, and will have to be undertaken by the dock yards or private contractors. This is true of all boilers, and as regards the removal of fixtures of the hull it depends on what extent of damage has been done to the boiler, because it is hard to imagine a case in which a boiler is damaged without some of the surrounding pipes, valves, etc., also being wrecked.

Taken altogether, the reasons given for adopting water tube boilers are open to discussion, inasmuch as no experience is forthcoming up to the present with regard to the behavior of these boilers in action, and consequently all questions of this character must be theoretical till practical experience is gained. The objections urged against the Belleville boiler by the committee appear, with one or two exceptions, to apply equally to all water tube boilers, and not one particular example more than another. Any boiler containing only a small quantity of water, and generating steam at very high pressures, is bound to be very sudden in all its actions, and to require considerable attention, which is much increased when the machinery that it supplies is being frequently stopped, started and worked, sometimes slowly and the next minute at maximum speed. This is the lot of naval engines, and to overcome these difficulties automatic gear is fitted to the boilers to control the various actions, and it is frequently difficult to decide which is the more troublesome—the automatic gear or the varying conditions of the boiler. In the channel squadron, where maneuvering is of daily occurrence at sea, the increase of power is often as much as 4,000 H.P. at one leap. All the battleships are supplied with fairly substantial machinery and Scotch boilers, and in spite of their most trying work seldom, if ever, fail. Indeed, the total defects of the eight battleships in a year is not equivalent to those of two of the cruisers fitted with water tube boilers. This latter feature would be of vital importance in war time. Without trustworthy machinery a warship is a poor substitute for a floating fortress.

LIMIT OF ECONOMY IN SPEED.

The Review published lately Mr. Tennyson d'Eyncourt's article upon the subject "On the Limits of Economical Speed of Ships," read before the Institution of Naval Architects. Engineering of London has published the following communication upon this article from Major G. Rota of Rome, which is given for the information which it contains:

"One of the conclusions Mr. Tennyson arrives at is as follows: 'If a speed be aimed at slightly above the limiting speed I have defined (corresponding at $v = \sqrt{L}$) with the indicated horse power increasing as more than the fourth power of the speed, it will be found possible to drive at that speed with the same horse power a vessel increased in one dimension, namely, in length, and proportionally in displacement.'

"This conclusion is quite correct, and agrees perfectly well with the experiments I made myself at the experimental tank at Spezia, the results of which I embodied in a paper I read at the International Congress of Naval Architects, held at Paris last year. Deduction No. 5 of this past paper runs as follows: 'Every hull derived from another one by changing the longitudinal dimension has a special speed, at which speed the increasing or the reduction of the displacement between ordinary limits does not require any notable increasing or reduction of horse power. The length of the hull and this speed are related to each other, approximately, by: $v=\sqrt{L}$ (where v is the speed in knots and L the length in feet).' From the above deduction we may pass to a more general one, and say: Every form of vessel or ship has, for any size we choose to give her, a special speed, and any increase or reduction in her length, though it bears a corresponding change in her displacement, does not require to drive her at that speed, any increasing or reduction of horse power."

At a directors' meeting of the Duluth, Mesabi & Northern Railroad Co., last week, the resignation of F. T. Gates as president and director (he was in full charge of the property when it was owned by Mr. John D. Rockefeller), was accepted and W. J. Olcott was elected president and A. B. Wolvin director. The resignation of George D. Rogers of New York, as assistant treasurer, was accepted and Charles E. Scheide of New York was elected to this office. The resignation of Edward V. Gary of New York, as assistant secretary, was accepted and Charles D. Fraser of Pittsburg was chosen to fill this vacancy. This action marks the formal retirement of Rockefeller officials in accordance with control of the road assumed some time ago by the management of the United States Steel Corporation.

POKING UP GREAT BRITAIN.

THE NATIONAL INDUSTRIAL ASSOCIATION HAS BEEN ORGANIZED FOR THAT PURPOSE—REFERENCES TO THE UNITED STATES.

At the recent Bradford conference of the National Industrial Association, Mr. James Lochrie dealt very fully with the aims and objects of the association and paid particular attention to the industrial gains of the United States. He also brought out the fact that the house of lords has recently determined that trade unions can be sued, which is a matter of vital importance. Mr. J. Pierpont Morgan recently stated that labor organizations in this country would have to be incorporated before he would negotiate further with them as a body. The effect of such action would be to make labor organizations responsible, instead as at present, irresponsible bodies. Among Mr. Lochie's sayings were the following:

"I happen to have a certain amount of leisure which, as a Briton, I believe I ought to devote to some endeavor to promote the benefit of my fellow-countrymen; and this is the form it has taken. I mention this particularly, as I have been often asked what I am going to get out of it and who pays me. What led me originally to conceive the scheme was the knowledge which came to me in my business capacity that large orders which we had been in the habit of filling from this country were being filled by America and Germany, and I came to the conclusion that our present generation being more or less in the position of trustees for future generations, it was necessary for us to hand down intact the birthright which our forefathers had worked so hard to obtain. We are a nation of shopkeepers, and it is to commerce that Britain owes its greatness. In commerce we live, move, have our life and very being, and so surely as our commerce deteriorates so surely will the greatness of the empire deteriorate. When we look abroad and find that nations to whom we used to export our manufactures are now sending us manufactures of a similar kind, and that their trade is proportionately advancing by greater leaps and bounds than ours; and that whereas we invested a large amount of capital abroad, these nations now have surplus capital which is being invested in this country, and that fleets of our steamships are passing into the hands of aliens, it is time every one should give some thought to the matter.

"We have also been asked questions as to what community of interest there is between, say the ship builder and marine engineer and the bricklayer and builder. It must be quite clear that while there is no direct connection between these two bodies, indirectly the one has a great bearing upon the other. It may be quite true that so far as foreign competition is concerned, the builder has little or nothing to fear; but in view of the fact that American companies are invading the country, providing the skill and the thought to settle, we will say by means of tubes, the question of the overcrowding of London, it must be clear that there may be other forms in which foreign competition may very strongly be brought to bear on the English builder. In addition to that it may be pointed out that if the steel manufacturer or the ship builder, the boiler maker or the cotton spinner, or any other exporter does not get a sufficient number of orders to keep his employes in full work, this will seriously affect the rents which are paid for houses, the number of houses which will be required, the price which the owner of the house can pay to the builder, and the day's wage which the builder can pay to his employe for constructing the house. It does not therefore affect the general principle of the scheme that there is no direct connection between any particular industry or trade in the country and foreign trade. While conversely the ship building and ship owning branches of the trade would not have been so flourishing had it not been for the large amount of money invested by the manufacturers in that particular district in British shipping; and if you look up the registers of the shareholders in steamers you will find that a large amount of capital has come from the manufacturing districts of England.

"One thing which I wish to impress upon this meeting, and which I seek to impress upon every meeting I attend, is that the association will not attempt in the slightest degree to interfere with existing organizations. If at any time the association should be requested to deal with any particular trade matter, it would only do so at the request of both parties, and provided it could supply competent men, who (for the sake of a name) we will call assessors, men who understand, not only the particular trade that asked for intervention, but who also possess the necessary local knowledge to enable them to express a fair and reasonable idea of the question which had to be dealt with.

"The principal aim of the proposed federation is the second, namely, to educate the minds of employers and employed concerning the grave responsibilities which rest upon them with respect to the expansion of British trade and commerce. We know the great advantages which the country at large has derived from elementary education. The minds of all have been expanded so that they are able to take a much more intelligent interest in whatever work they have to do by reason of the increased power of comprehension which their school training has afforded them; and the result is that at the present time there is no limit to the success in life which may be achieved by any one who has a sufficient amount of perseverance and applies it intelligently, and we feel that the more highly educated we get the less likely we are to resort to offensive measures to obtain any amelioration of our lot to which we are justly entitled. I do not use the word education in the narrow sense. I mean the education of the adult, the education that Samuel Smiles defined when he wrote, 'Schools, academies, and universities give but the beginning of education.' There is no doubt that in the matter of education we are greatly below the continental standard.

"It does not require any very deep thought to see that this association may serve several very useful purposes in connection with the engineering trades. In view of the vast amount of work which lies before the engineers and manufacturers of this country, and the certainty that it will continually increase, it is exceedingly desirable that everything possible and reasonable should be done to ensure harmonious working. The effects of the 1897 engineering strike were severely felt both by masters and men, and national industry was disorganized, to the benefit of the foreigner. We are today assured that many union men who struck work against the policy of certain employers who declined to permit their manufactories to be controlled by union principles, are now convinced that the actual labor conditions in at least one of these instances which we specially call to mind are vastly superior to other shops which are allied to the unions. In fact, the men have not hesitated to set down their opinion to this effect in black and white. But it should not be the intention of the National Industrial Association to take up a premeditatedly hostile line to trades unionism; nor on the other hand should it propose to look at questions expressly from their particular point of view. Its mode of operation appears to be clearly indicated in the fundamental idea, which is to produce harmonious working all round. Engineering competition with foreign countries is daily becoming keener and keener—hence we have an additional reason for enabling things to run with a maximum of smoothness.

"Unfortunately, English manufacturers in the electrical engineering line, for instance, do not appear to be anything like alive to the great necessity for centering their attention upon foreign trade. We have become accustomed to hear that this, that, or the other large American firm has secured this, that, or the other important electric power or traction concession in India, in Australia, in Africa. It would seem, from what we hear, that English manufacturers do not bestir themselves sufficiently to enter closely into competition with German and American rivals in the motor and generator business abroad. The association might do our national industries an excellent turn by procuring such information, and preparing it in such a convincing manner, as shall bring the vital importance of foreign electrical expansion home to the leaders of our national electrical engineering. We have to encounter competition in the electrical supply business even within these tight little islands, but we seem to be less prepared to cope with it in our colonies and in foreign countries, where our supremacy ought to be maintained for the sake of the future. Foreign works appear to be more enterprising in sending out engineers to secure concessions, and obtain orders and contracts, than are many of our English houses. The English technical press has made many endeavors to send this truth deeply home, and the statements issued from time to time by our consuls away in the foreign markets furnish strong confirmation—if any be needed—of the accuracy of this view. There is another direction, also, in which invaluable service may be rendered to the electrical trade and profession. Our legislators do not yet appreciate the great importance of the industry, nor do they yet fully grasp—as practical electrical men do—the full extent of the obstructive effect of parliamentary measures. Happily, the events of the past year or two have shown that even members of parliament are becoming more enlightened than they were in the early nineties and the eighties, when the electrical industry labored under a load of grievances; but there yet remain to be seriously considered many points which, if the electrical industry is to be allowed the fullest degree of development to meet the needs of our progressive civilization, must be eased by a greater encouragement and more sympathetic legislation. Further, if the electrical employe can be made better acquainted with the real difficulties confronting his master's business, and can be kept posted as to the progress and new developments of electrical engineering throughout the world, the result cannot be other than beneficial. He may be made to see that foreign competition is no bogey, but is a real and important force, and we may go a long way to teach him these things by the circulation of suitable literature or by the reprinting and distribution—after discreet selection—of practical and useful articles which are now buried away in the columns of the technical press. By circulation in the manner now proposed, much might be done to broaden the workman's mind, to enlarge his interest in national and therefore individual well-being, and lead him to entertain a more charitable regard for his employers.

"The sending of joint deputations of employers and employes to the various central points of the markets of the world is also a commendable proposition in connection with electrical and engineering work generally. As we have said, the foreign electrical trade is now more or less neglected by many English manufacturers, and to be brought personally into touch with the actual markets must infuse new energy and enterprise into the heads of firms or of departments, and their subordinates in the same way might catch the self-same spirit and exercise it in their own sphere of operation. We shall be able to ascertain just what are the real characteristics of the particular trades of those countries, and to calculate the course of action which our own firms or companies should adopt in regard thereto so as to lead to success.

"It is our opinion that strikes and lockouts are—or, at least, ought to be—out of date. In these days of progress and advance in every direction, when scientific methods are everywhere replacing the old rule-of-thumb systems, it is absurd to continue practices which may have satisfied our great-grandfathers, but which ought to have no place in the economy of the twentieth century. Labor organizations have now compelled recognition on the part of employers' federations, and, whether this fact be palatable or not to the latter bodies, it is impossible to get away from it. The recent decision of the house of lords that trades unions can be sued is, to our thinking, a most satisfactory one. It lifts workmen's societies out of the rut of irresponsibility, and places them upon an altogether more dignified plane. It is likely to have the result of making trades unions less reckless in their dealings with federations of masters, and more desirous than formerly to leave no stone unturned to come to amicable agreements. Organizations on either side will, we hope, in cases of future disputes, which it has been found impossible to adjust, meet not in battle array, but on a businesslike footing, and settle their differences in a manner compatible with the spirit of the age in which we live. Decisions will be come to, and agreements made which either side will loyally adhere to, for there must be no violation of contract similar to that which occurred in the case of the recent strike of American mechanics. Extreme measures, such as strikes and lockouts, if they are not entirely done away with, will, we trust, in time become so rare as to render their vicious and ill effects more realized than they are at present. It is not only the direct consequences of such industrial warfare which are so bad; the actual loss in production and wealth which result from them are bad enough, but even more serious than this, and more lasting in its effects, is the influence that they have upon the character and morality of those who take part in them. We do not think this aspect of strikes is sufficiently realized by people generally, and we desire to emphasize it as strongly as possible in dealing with this question. The hatred and bitterness engendered by strikes and lockouts on either side are such that no effort can be too great, no labor too long to avoid them.

"In past times very little sympathy has existed between the two

classes (masters and men), and each has looked upon the other as an antagonist, and sometimes as an enemy. So strong has the feeling of hate been, especially in times of dispute, that many of the best men in the country have despaired of the reconciliation of capital and labor on terms which would make possible their permanently continuing to work together. This opinion has led the more extreme section to advocate a communized or socialized state of society, where the state shall control industry and be the sole owner of property, so far as land and houses are concerned. Others conceive the notion that a common interest may be established among the workers, by which they may become their own masters, and together cooperate both in producing and distributing the necessaries and the luxuries of life. There is another class who are less desponding, who thoroughly believe in the present system of commerce as being the only means by which a healthy, and what they believe necessary, competition among men and nations can be successfully carried on, without which, they think, there would be wanting the essential element of ambition and the desire to acquire which gives push and go to commercial enterprise. These persons think that what is needed is to remove class prejudices and jealousies, and bring both parties to take a reasonable view of things, and respect each other's rightful claims and lawful ambitions; that where it is found practicable employers should take their workmen into their confidence and give them to know and realize the responsibilities attendant on the establishment and management of large business, and encourage them to do well to the business as workmen, by giving them a share in the profits in addition to wages. But the more general opinion, and one that is shared by a number of large and influential business men, is that the proper thing to do is to create a national organization of employers and workmen's societies with a view of arriving at an understanding as to the rightful claims of masters and workmen, with a disposition to respect those claims, and thus end the perpetual strife between hand and head, which when rightly understood are intended to serve each other and are each equally necessary, but when separated perform no useful service."

TRADE NOTES.

The Knecht Bros. Co., Cincinnati, has issued a little catalogue devoted to a friction sensitive drill press. Its advantages, as claimed in the catalogue, consist of a variation of speed without cone pulleys or shifting of belts.

Since the Pan-American exposition opened at Buffalo, the American Ship Windlass Co. of Providence, R. I., has sold the No. 0 towing machine which they have on exhibition there and also the No. 4 towing machine on exhibition. The No. 4 machine is to go to parties who less than a year ago ordered four No. 3 machines of this kind.

The B. F. Sturtevant Co., Boston, Mass., has upon the press a very complete catalogue of its motors, generators and generating sets. Previous publications have been in the form of bulletins descriptive of special types. This catalogue will present them all and will in some degree reveal the fact that, although the Sturtevant company has a world-wide reputation as blower manufacturers, its business is by no means limited to the production of these machines, but that it is also equipped with a most complete line of engine and motor designs.

Although linotype operators have been using graphite to a more or less degree for years, it is only within the last few months that they have found the kind peculiarly suited to the actual needs of the machine. The Joseph Dixon Crucible Co., Jersey City, N. J., prepare a special linotype graphite, and send samples free and testimonial letters to any one interested.

In view of the fact that the space devoted to floor molding has been entirely inadequate to demands of the business, and in order to relieve the establishment at Canal and Judd streets of some of the heavy work, Crane Co., Chicago, has this summer erected at its works at Jefferson, Van Buren and Desplaines streets, a foundry which is to be devoted exclusively to very heavy work, i. e., flanged fittings and large valves. It is a one-story brick building with a slate roof, and is equipped with two cupolas, an electric traveling crane, and every other modern convenience. This new foundry will increase Crane Co.'s capacity for very heavy work about 50 per cent., and it is expected to be in operation in about thirty days.

SHIP BUILDING NOTES.

Kelley, Spear & Co., Bath, Me., have built 110 wooden vessels since 1887. The list includes one bark, two steam barks, one barkentine, four two-masted schooners, twenty three-masted schooners, thirteen four-masted schooners, six scows, one stern-wheel steamer, one raft boat, two towboats, one ferry boat, one dredge and fifty-seven barges.

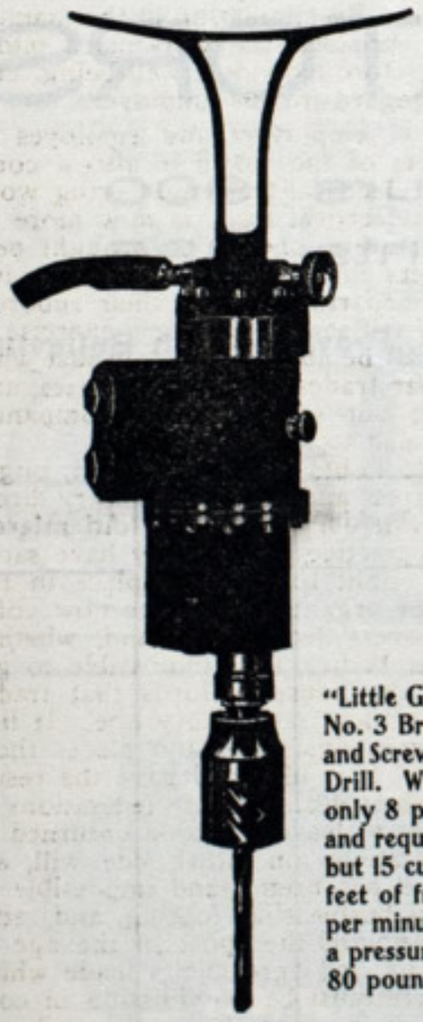
The Pennsylvania Railroad Co. has just given the Wm. R. Trigg Co., Richmond, Va., a contract for a steel tug-boat of the following dimensions: Length over all, 105 ft.; molded beam, 22 ft.; depth, 12 ft. 2 in.; draught, 9 ft. 3 in.

The Standard Ship Building Co. has been incorporated with a capital stock of $200,000, of which $125,000 is paid in, to re-establish the ship building business formerly conducted by the late Hugh Ramsay at Perth Amboy, N. J.

F. S. Bowker of Phippsburg has received a contract to build a three-masted wooden schooner for Capt. Feore of Scranton, Miss., of the following dimensions: : Length, 135 ft.; breadth, 10 ft.; depth, 10 ft.

A contract for two wooden barges of a carrying capacity of 4,000 tons of coal has just been awarded to the Kelley & Spear Co., Bath, Me., by the Staples Coal Co.

A British admiralty chart, Midland section of Georgian bay, will be sent, postpaid, to any address for $1.25; regular price $1.75. Size of sheet 3x4 ft. The Marine Review Pub. Co., Perry-Payne building, Cleveland. Chart of the whole bay on one sheet at the same price.



"Little Giant" No. 3 Breast and Screw Feed Drill. Weighs only 8 pounds and requires but 15 cubic feet of free air per minute at a pressure of 80 pounds.

"Thirty Days and Costs"

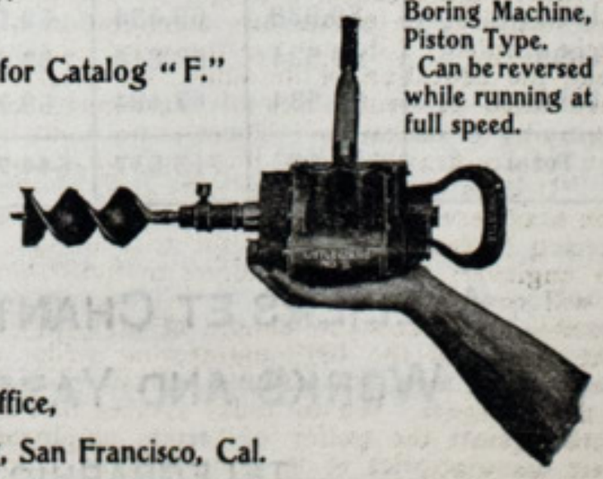
has an ominous sound, but, in this case, it represents a liberal offer. We offer you a 30 days' trial of any **"Little Giant"** Pneumatic Tool, and we pay all the costs of transportation, even if you send it back. That's "thirty days and costs" on us.

We make this offer because in no other way can we so thoroughly demonstrate the all around excellence and general superiority of **"Little Giant"** Pneumatic Tools as by putting them right into your hands for a severe trial, making you judge and jury, and because past experience has shown us that to put **"Little Giant"** Tools into the hands of even a mechanic who is prejudiced in favor of another make, will almost invariably win him over to our side and make of him a good strong witness in the court of public opinion.

"Little Giant" Pneumatic Tools have won a world-wide reputation for simplicity, durability and economy in the use of air, and are supplanting the ordinarily good pneumatic tools in many shops. They are small and compact, easily handled and operated and are made entirely of steel.

Send for our catalog, which illustrates and describes our entire line of Drills, Hammers, Riveters, Hoists, and other Pneumatic Tools and Appliances, and choose the tool you'd like to try. Do it to-day.

Ask for Catalog "F."



No. 5 Reversible Boring Machine, Piston Type. Can be reversed while running at full speed.

STANDARD PNEUMATIC TOOL CO.

Main Offices, Marquette Building, CHICAGO.

Eastern Offices, 141 Broadway, New York.

Pacific Coast Office,
423 Emma Spreckels Building, San Francisco, Cal.

GREAT DEVELOPMENT PREDICTED FOR CANADA.

At the banquet after the launch of the freight and passenger steamer Huronic at the yard of the Collingwood Ship Building Co., Collingwood, Ont., last Thursday, Mr. John Long, the president of the ship building company, spoke of the need of a bonus to stimulate for the present steel ship building in the Dominion. He declared that foreign ships should have only such rights in Canada as Canadian ships have in the countries from which the foreign bottoms come. He added that it was the development in the west of Canada that had encouraged his company to take up ship building. Hon. Israel Tarte, minister of public works, spoke as follows:

"Canada is making splendid progress. I altogether decline to agree with those who find cause for disappointment in the last census. We are doing remarkably well. We often forget we are a young country. Confederation is only thirty years old, just long enough to have laid the foundations of this country. The launching of that noble ship is the best evidence that we are doing well. At confederation, Canada consisted of small and scattered communities. We are understanding each other better and better, and Canada stands today a united nation. We invite foreign capital to Canada, provided it comes to us to stay. A few days ago I had to refuse the offer of Capt. Wolvin. I would have been unworthy the confidence of the Canadian parliament had I done anything else. We are short of Canadian bottoms to carry Canadian trade. The present Canadian bottoms cannot carry more than 5,000,000 bushels of grain. We are short of Canadian bottoms, but we are not short of courage, and we have the spirit and enterprise and the skilled labor to make good the deficiency. Let us keep cool; let us not give away our national property because we are not immediately ready to handle all our trade. Let us be for this country before everything else, and we will come out all right."

Mr. Tarte then directed some attention to the railways. He said: "The transportation question is to be solved. We are solving it by improvements. The railways will have to help us. I am glad to see here my friend Mr. Reeve, general manager of the Grand Trunk. The Grand Trunk Railway Co. is powerful, but not as powerful as the Canadian people. We are their bosses. They have their terminal now at Portland, but the time will come when the Grand Trunk will be glad to come back to Canada, because we have the shortest route to the English market. We look to them to make it the best, and the Grand Trunk will realize that as soon as the facilities of the St. Lawrence river are sufficient. We will have to spend money. Great as I am, I cannot do it without money. (Laughter and applause). Master of the administration, as I am, I cannot do it without money. The question is, will the Canadian people fully make up their minds to stand by their own country? You have heard of the possibility of the government bonusing ship building. Well, for a free trade government it is a pretty hard thing to do. The Americans have closed their doors to us. We should keep our trade for ourselves. Ship building might be bonused for two or three years if enough Canadian bottoms could be built in that time to carry Canadian trade in Canadian channels. In the meantime the ports of Quebec and Montreal and St. John, will be made right. Do you appreciate the magnitude of the possibilities we have in hand? Let us have a sufficient Canadian lake marine; we will be a great nation quicker than most people believe. We will make greater progress in the next ten years than in the last forty years."

Capt. Alexander McDougall spoke upon the growth of Canada's trade and facilities. He approved the system of waterways furthered by Mr. Tarte. He declared that the lake marine and ocean marine must remain separate. To unite them would not pay. There must, he said, be transhipment at the seaboard.

FOR NEW ORLEANS AND CANADIAN SERVICE.

Messrs. Furness, Withy & Co., Ltd., recently launched from their Middleton ship yard, West Hartlepool, England, the large steel screw steamer Manchester Exchange, built to the order of the Manchester Liners, Ltd., for their Manchester canal, New Orleans and Canadian services. This vessel is 372 ft. in length; of the spar deck type, with two steel decks laid all-fore-and-aft, and she has poop, bridge and forecastle. The scantlings are considerably in excess of Lloyd's highest class, and the vessel is specially strengthened to suit the heavy Atlantic trade. She has a total capacity of 354,549 cu. ft. Cellular double-bottom is fitted all-fore-and-aft for water ballast, and a specially strengthened deep tank is fitted just aft of the engine room, both the fore and after peaks being also available for water ballast, giving a total ballast capacity of 1,350 tons. The Manchester Exchange is divided into six water tight compartments by means of seven bulkheads, each compartment being fitted with complete central iron grain divisions. A complete system of ventilation is arranged throughout the ship. She has six large cargo hatches, nine powerful steam winches, large multitubular donkey boiler and twelve derricks. Special attention will be paid to the bunkering arrangements to ensure the coaling being carried out in an efficient manner. A powerful steam windlass will be fitted forward for working the cables. Steam steering gear will be fitted under the bridge. She will be lighted throughout by electricity and fitted up as a first-class cargo boat, including all the most modern improvements. The accommodation for the captain, with saloon and two spare staterooms, etc., is arranged on the bridge deck in a large steel deckhouse, with separate house for officers and engineers at the after end of the bridge, and the seamen and firemen under the forecastle. The vessel will be rigged as a two-masted, fore-and-aft schooner, with telescopic masts to suit the canal bridges. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders 25, 40 and 68 in. diameter and 48 in. stroke, steam being supplied by three single-ended boilers, 14 ft. 6 in. diameter by 11 ft. long and 180 lbs. pressure.

Low Rate Excursion to New York via B. & O.—Tickets on sale daily until Oct. 20 with privilege of returning via Buffalo. Call at city ticket office, 241 Superior street. Oct. 20.

BELLEVILLE GENERATORS

Grand Prix 1889
Originated 1849

Hors Concours 1900
Latest Improvements 1896

Number of Nautical Miles made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australien	Polynésien	Armand Béhic	Ville de la Ciotat	Ernest Simons	Chili	Cordillère	Laos	Indus	Tonkin	Annam	Atlantique
1890.....	67,728	2,460										
1891.....	68,247	68,331	204									
1892.....	68,247	68,403	69,822	23,259								
1893.....	68,379	68,343	68,286	68,247								
1894.....	68,439	68,367	68,574	68,439	37,701							
1895.....	68,673	68,766	68,739	68,808	40,887	28,713						
1896.....	69,534	92,718	69,696	69,549	62,205	63,153	40,716					
1897.....	68,250	69,606	92,736	69,555	62,235	76,110	63,357	43,146				
1898.....	70,938	69,534	69,552	69,597	62,526	63,240	63,240	62,553	63,954	22,707		
1899.....	69,534	69,615	67,431	90,405	60,246	62,778	62,868	52,344	54,855	44,007	22,884	
1900.....	69,534	67,494	69,744	69,564	61,719	62,382	62,502	51,471	53,373	62,016	63,066	52,140
Total.....	757,503	713,637	644,784	597,423	387,519	356,376	292,683	209,514	172,182	128,730	85,950	52,140

ATELIERS ET CHANTIERS DE L'ERMITAGE, À ST. DENIS (SEINE), FRANCE.
WORKS AND YARDS OF L'ERMITAGE AT ST. DENIS (SEINE), FRANCE.
TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT-DENIS-SUR-SEINE.

BUREAU VERITAS IN CANADA.

For some reason Bureau Veritas, the French society which is an authority throughout the world in the classification of ships, has not in the past been recognized as Lloyd's is in Canada. This has probably been due to the limited ship building interests of the dominion. Canada has, however, been building some ships of late and talking of building a great many more. Bureau Veritas has therefore sought recognition and it has been granted. Capt. F. D. Herriman of Cleveland, chief surveyor for the Great Lakes Register, which is published in conjunction with Bureau Veritas, has just received a copy of a letter from F. Gourdeau, deputy minister of marine and fisheries in Canada, to Thos. R. Miller of London, chairman of the British committee of the French register. The deputy minister says: "Referring to your letter of August 2, inquiring if this department has any further communication to make respecting the steamboat inspection act, and the desire of the Bureau Veritas to have their certificates recognized under that act, I beg to inform you that by order in council of May 3, 1901, on the recommendation of the minister of marine and fisheries, the society of Bureau Veritas and the society called the British Corporation for the Survey and Registration of Shipping were admitted to the same privileges as English Lloyd's and the Imperial Board of Trade as defined in the order in council of May 30, 1893, and that their certificates of inspection are to be accepted for the same purposes and to the same extent only as are English Lloyd's and the Imperial Board of Trade certificates as defined in the above mentioned order in council of May 30, 1893.

STEEL PROPELLER WHEELS.

It is safe to say that the year 1901 will show a larger number of steel propeller wheels having been made up than the total for any two previous years, the Marine Iron Works (Station A, Chicago) alone having more than doubled any previous year's sales on these steel wheels, with three months yet to hear from. The composition being an open hearth homogeneous steel, is exceedingly tough and ductile. The sizes range from 30 in. diameter up to 5 ft. The higher first cost when compared with the cast iron wheels is very quickly earned, especially where boats are operating at times on somewhat shallow water. 8

Sealed proposals for building Light Vessel No. 75 will be received and opened in the office of the Light-House Inspector, Detroit, Mich., at noon, October 1st, 1901. Blue prints, specifications and all particulars concerning the light vessel referred to can be obtained by application to the office of the Light-House Inspector, Detroit, Mich.
Sept. 19

STEAMER FOR SALE.

The package freight steamer Avon, which was recently slightly damaged by fire, now lying in the port of Buffalo, is offered for sale. Would make an excellent steam barge for the lumber trade. Inquire of H. C. French, president and general manager, the Union Transit Co., Buffalo, N. Y.
Sept. 26.

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THE MOST MARVELOUS METAL POLISH IN THE WORLD.

In Liquid and Paste Form.

Will Polish Hot or Cold Metal,

no matter which.

Produces a wonderfully brilliant lustre on brass, copper, nickel and all metals, no labor required.

Used on steamers all over the world.
Free samples on application.

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57 Dearborn St., CHICAGO, ILL.

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"Seaboard Steel Castings."

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THE LATEST AND BEST STOCKLESS ANCHOR.
APPROVED BY LLOYD'S.

ANCHORS CAST AND TESTED ON ORDER, OR STOCK ORDERS PROMPTLY FILLED.

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OPEN-HEARTH STEEL CASTINGS OF THE HIGHEST GRADE.
FACILITIES FOR CASTINGS UP TO 80,000 POUNDS WEIGHT.
MACHINE WORK AND PATTERNS FURNISHED WHEN REQUIRED.
RAIL OR WATER DELIVERIES.
CAPACITY, 1500 TONS PER MONTH

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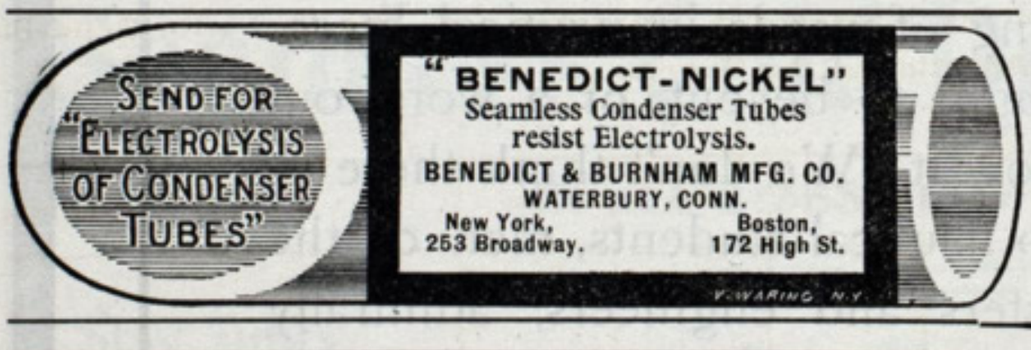
CHESTER, PA.

The Erie & Western Transportation Co. ANCHOR LINE. 1901.

Passenger Service—
Steamers.....India, China, Japan.
Ports of call... Buffalo, Detroit, Erie, Sault Ste. Marie, Mackinac Island, Hancock, Port Huron, Marquette, Duluth, Cleveland, Houghton.

Freight Service—
Steamers.....Alaska, Schuylkill, Delaware, Lycoming, Conemaugh, Codorus, Conestoga, Juniata, Mahoning, Clarion, Lehigh, Susquehanna, Wissahickon.
Ports of call... Buffalo, Detroit, Houghton, Erie, W. Superior, Sault Ste. Marie, Cleveland, Hancock, Chicago, Marquette, Duluth, Milwaukee.

CHAS. E. MARKHAN, Gen. Pass. Agt., Buffalo, N. Y.
E. T. EVANS, Western Manager, Buffalo, N. Y.



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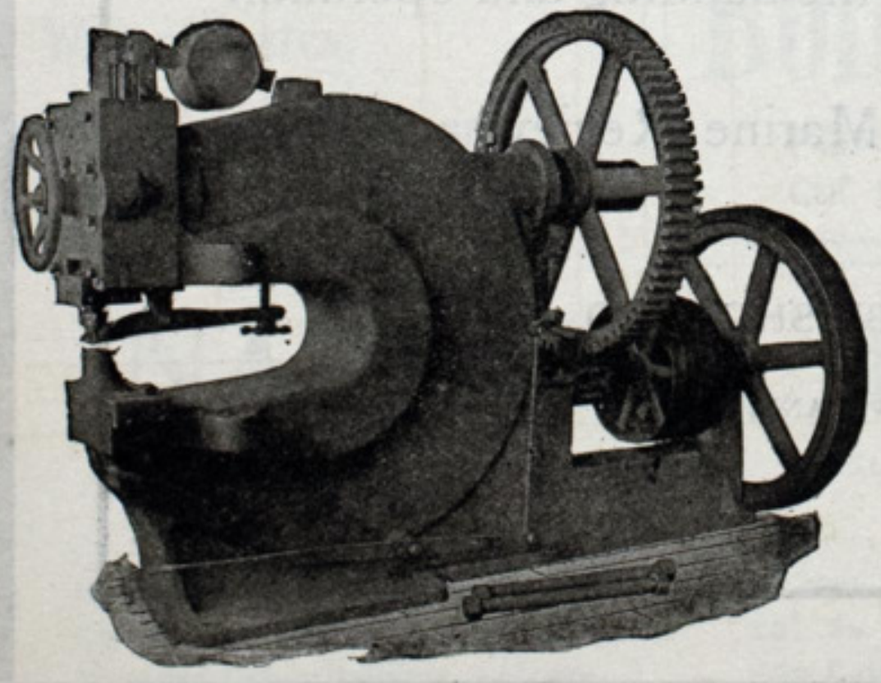

THIS ILLUSTRATES OUR

Standard Boiler Maker's Punch

which is similar to our iron worker's punch with the exception that it is equipped with a plain jaw instead of an architectural jaw. We believe that this is the best punch for boiler makers on the market to-day, and for strength, reliability, and beauty of design we think it is unequaled. We can refer you to hundreds of the largest shops all over the world where we have installed one or more of these tools, and where they are giving the best of satisfaction and service.

Let us hear from you if you are in the market for a tool of this kind. We think we can interest you both as regards quality and price.

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CLEVELAND, O., U. S. A.

Here is a Book You Should Have.

Patterson's Illustrated Nautical Encyclopedia

YOU have no book like it upon your shelves because there is no book like it in existence. It is the only work of its kind extant. It covers the whole field of naval architecture, marine engineering and navigation. It concentrates its whole energy upon the sea and its ships. Within its limited scope there is nothing lacking. To those who are interested in shipping, ship building and sailing it is the best dictionary ever written. Its definitions are clear and authentic, and there are 6,000 of them. Its illustrations are carefully drawn and engraved and there are 500 of them.

The book is bound in white duck and stamped with blue ink and is most fetching to the eye. Between its covers 500 pages are devoted to defining the meaning of words in nautical literature. If there is a word in that ought to be out, or a word out that ought to be in, we should know it. We don't think there is.

The book is of vital interest to nautical students, men of the merchant marine and navy, masters and engineers, admiralty lawyers and everyone concerned about the building and operation of a ship.

It is fresh from the press of the Marine Review and is for sale at $3.00 per copy. Address

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WILL DAMP-PROOF YOUR FLOATING EQUIPMENT.
A PROTECTOR AGAINST RUST AND DECAY.

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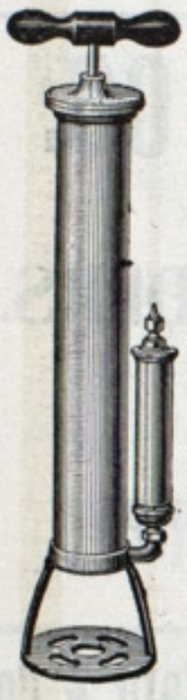
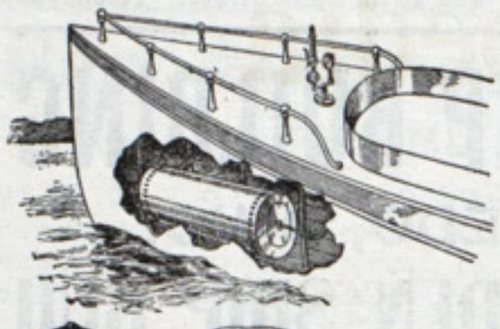

AIR PUMPS,
all sizes and all kinds.
Also, WHISTLES, TANKS, Etc.
MANUFACTURED BY
The Gleason-Peters Air Pump Co.
20 W. Houston St., NEW YORK, U. S. A.

BERTHS • BUNKS • BEDDING

Practical sanitary ideas in Metal Berths.
Made to fold up or drop down.
Made on hygienic principles that are already popular.

PERFECTION BERTHS are endorsed by the ARMY AND NAVY Authorities and by leading Ship Builders. Full line Patent Metal Berths. Hardwood front Berths, any finish. Standee Berths, Extension Berths for cabin use. Forecastle and Steerage Berths of most approved styles. Portable Cabins. Can be removed without use of tools. All vermin-proof. Let us quote you prices on your wants in Berth and Bedding.

MADE ONLY BY
LEIN, IRVINE & COMPANY, 328 to 332 E. Twenty-third Street, NEW YORK CITY.

Interest in Steam Barge For Sale.

Half interest in steambarge of 776 tons, A2 class and capable of carrying 950 tons of coal or 650 M ft. lumber. Compound engine and good boiler, the latter allowed 120 lbs. steam pressure. Address or apply to J. E. M., 23 Lodge avenue, Cleveland, O. d

Wanted—Leading Marine Engine Draughtsman.

Well up in best lake practice. Address "Ship Yard," care Marine Review Pub. Co., Perry-Payne building, Cleveland, O., with requirements as to salary. All applications strictly confidential. Sept. 26.

TUG FOR SALE.

Wood hull 61 ft. long, 14 ft. 8 in. beam. Iron house. Engine 16¼ by 18 in. Boiler pressure allowed, 140 lbs. Price $2600. Inquire C. H. Strong & Son, No. 622 Cuyahoga building, Cleveland, O. d

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MANUFACTURERS OF

Seamless Cold Drawn Steel Tubing

IN ALL SIZES FROM ⅛ TO 16″ DIAMETER.

Stay Tubes,
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Compressed Air and
High Steam Pressures.

Boiler Tubes
FOR ALL CLASSES
OF MARINE WORK.

Hollow Shafts,
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SELLING AGENTS,

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Dearborn Vegetable Boiler Compounds.

SCIENTIFICALLY AND UNIFORMLY MADE. EVER RELIABLE.

Most Scientifically equipped, Complete, Handsome and expensively Furnished Laboratories, and the ONLY EXCLUSIVE LABORATORIES ON STEAM ECONOMY in the Country.

MARINE FORMULA NO. 5, For the WATERS of the FIVE LAKES.

To prevent pitting, neutralize the oil, stop incrustation, and as a perfect preservative to the iron, boiler, and all its connections—especially prepared for the marine trade of the lakes.

If you are using a different water, prepay the express on a gallon jug of your feed water to the DEARBORN LABORATORIES at CHICAGO and receive a copy of analysis of same, with a written diagnosis of your case, and a letter giving you all the valuable information we can, and the actual cost of what it will require to clean your boilers and keep them clean. All of this will be done free of charge, and optional with you whether you order or not. When in Chicago call and inspect our Laboratories.

Analyzers of Everything.
Makers of Boiler Compounds.

DEARBORN DRUG & CHEMICAL WORKS
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WM. H. EDGAR, President.
Manufacturing and Analytical Chemists.

OFFICES: 29, 30, 31, 32 and 33 Rialto Building. Telephone, Harrison, 1373. WORKS: 23, 25, 27 and 29 La Salle Street. Telephone No. 1130 South.

CRAIG SHIP BUILDING CO.

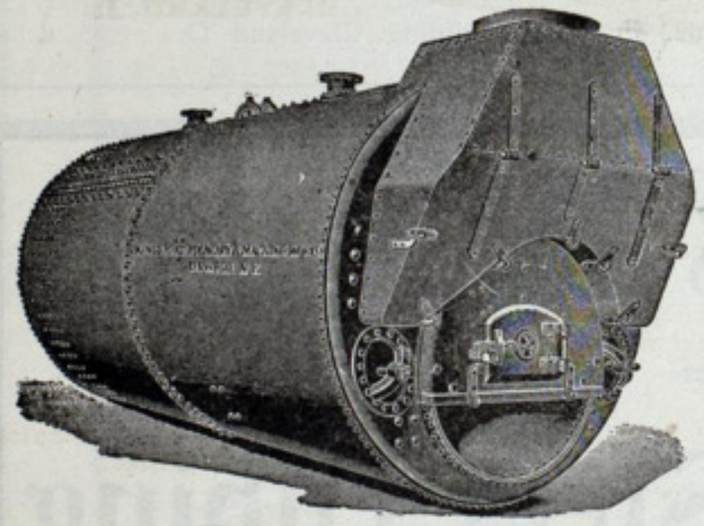
TOLEDO, OHIO,

METAL AND WOODEN SHIP BUILDERS.

New Dry Dock—450 feet long, 110 feet wide on top, 55 feet wide on bottom, 16 feet of Water on Sill.

Repairs to Metal and Wooden Ships

A SPECIALTY.



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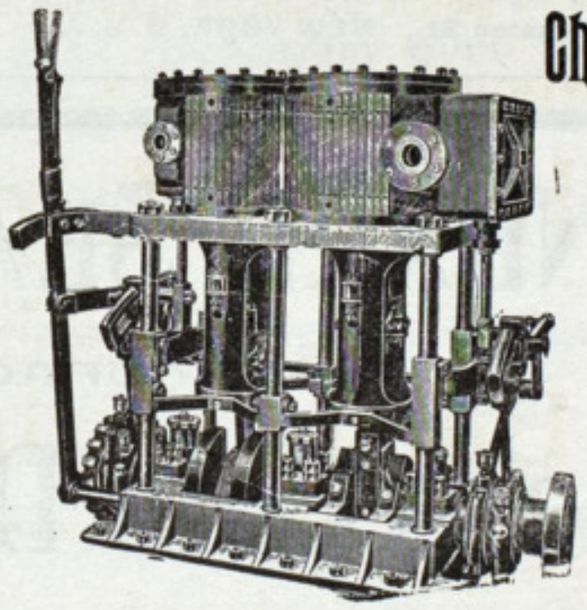
Centrifugal Pumping Machinery for all Purposes.

Kingsford Foundry and Machine Works,
OSWEGO, N. Y.



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F. C. WALTER, Manager.
45-49 S. Canal St., CHICAGO.

BUILDERS OF
Marine Engines and Boilers,
Paddle Wheel Engines,
Boat Machinery,
High Pressure, Compound and Triple Expansion Engines,
Yachts and Launches.

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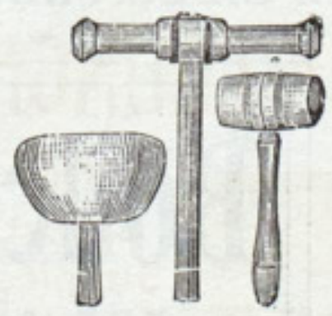
R. D. WOOD & CO.

400 Chestnut Street,
PHILADELPHIA, PA.

Hydraulic Riveters, Shears, Intensifiers, Presses, Valves, Lifts, Etc.
Producer Plants with Bildt Feed for operating Gas Engines, and for Metallurgical and other uses.

LARGE LOAM CASTINGS, SUGAR HOUSE WORK, GAS AND WATER APPLIANCES.



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CAULKING MALLETS

NOW USED IN ALL THE SHIP YARDS OF THE WORLD.

Specialties: Boiler Makers' Mauls, Stone Cutters' Mallets, Hawsing Beetles, and all kinds of Mallets.

Illustrated Catalogue and Price List upon application.

N. Y. MALLET & HANDLE WORKS,
Established 1845.
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NAVIGATION SIMPLIFIED.

Not an elaborate technical work—just an assistant for the seaman and a book of valuable plain instruction for beginners.

Contains problems required in examinations that are given by government inspectors to masters and mates of sea-going vessels.

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CLOTH BINDING, $1.25. PAPER BINDING, $1.00.

THE MARINE REVIEW PUB. CO, PERRY-PAYNE BLDG., CLEVELAND, O

Absolute extinction of fires in holds or bunkers of ships no matter what the cargo.

Machine installed weighs 3800 lbs.

THE CLAYTON FIRE EXTINGUISHING AND DISINFECTING COMPANY
11 BROADWAY, NEW YORK.

C&B LINE

Pan-American Route

between **CLEVELAND** and **BUFFALO.**

STEAMERS CITY OF BUFFALO AND CITY OF ERIE.

Finest and fastest passenger steamers in the United States.

TIME CARD—DAILY—APRIL 15 TO DEC. 1.

Leave Cleveland 8 p. m. Arrive Buffalo 6.30 a. m.
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ADDITIONAL SERVICE DURING JULY AND AUGUST.

Connections made at Buffalo with trains for all Eastern and Canadian points; at Cleveland for Detroit and all points West and Southwest.

SPECIAL LOW RATES CLEVELAND TO BUFFALO AND NIAGARA FALLS EVERY SATURDAY NIGHT, ALSO BUFFALO TO CLEVELAND.

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MANUFACTURERS OF

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ONE OF THESE BINDERS

that will hold 52 NUMBERS of the

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Will be mailed to any address on receipt of $1.

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Pintsch Gas Lighted Buoys

Adopted by the English, German, French, Russian, Italian, and United States Light House Departments, for Channel and Harbor Lighting; over 1000 gas buoys and gas beacons in service.

Burn Continuously

from 80 to 365 days and nights without attention, and can be seen a distance of six miles.

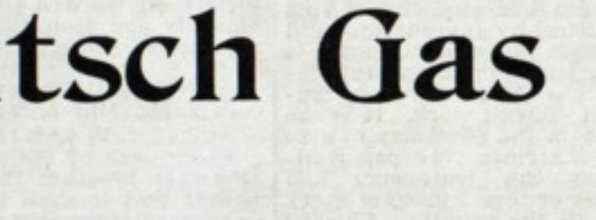
Brilliant and Steady Illumination.

Economical and Reliable in Operation.

Controlled by the SAFETY CAR HEATING AND LIGHTING CO.,
160 Broadway, New York City.

THE ONLY NAPHTHA LAUNCH.

NEARLY 3,000 IN USE.



The Safest, Simplest, Speediest power boat.

Superiority demonstrated by ten years' experience.

STEAM AND SAIL YACHTS.
MARINE ENGINES AND "SEABURY" WATER TUBE BOILERS.

GAS ENGINE & POWER CO., AND CHARLES L. SEABURY & CO., Consolidated.

Morris Heights, New York City.

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FOGG'S RESILIENT FELT MATTRESSES AND CUSHIONS

MANUFACTURED BY

M. W. FOGG,

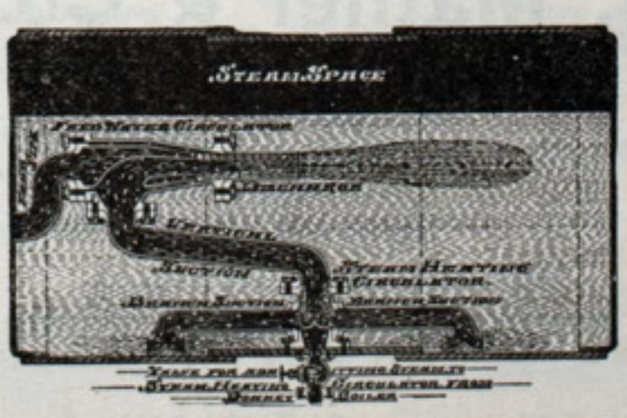
20 Fulton St., NEW YORK.

Send for Illustrated Catalogue.

The Equilibrium Circulator and Steam Heating Attachment.

INCREASES EVAPORATION 5 TO 15%.

PAYS FOR ITSELF WITH SAVING IN REPAIRS.



KEEPS ALL PARTS OF BOILER AT AN EVEN TEMPERATURE.

No extra joints to leak.

Creates a constant automatic circulation as long as boiler is fed.

106 in use. 50 orders.

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112 35th Street. NEWPORT NEWS, VA.

The W. L. SCOTT COMPANY, ERIE, PA.

WHOLESALE DEALER IN

SHAMOKIN ANTHRACITE WILKESBARRE **COALS** YOUGHIOGHENY PITTSBURG MANSFIELD

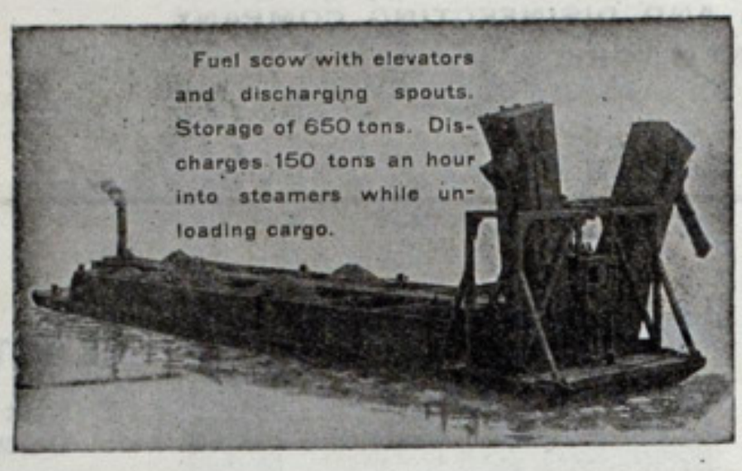
VESSEL FUELING A SPECIALTY By STEAM LIGHTER or Car Dump at all hours. Electric Light.

Main Office, Scott Block, Long Distance Telephone No. 440.
Fueling Office, Canal Dock, Long Distance Telephone No. 320.

Steamboat Fuel at Ashtabula. LARGE SUPPLIES OF BEST QUALITY

Lighter

Carrying Different Grades at all Times.



Fuel scow with elevators and discharging spouts. Storage of 650 tons. Discharges 150 tons an hour into steamers while unloading cargo.

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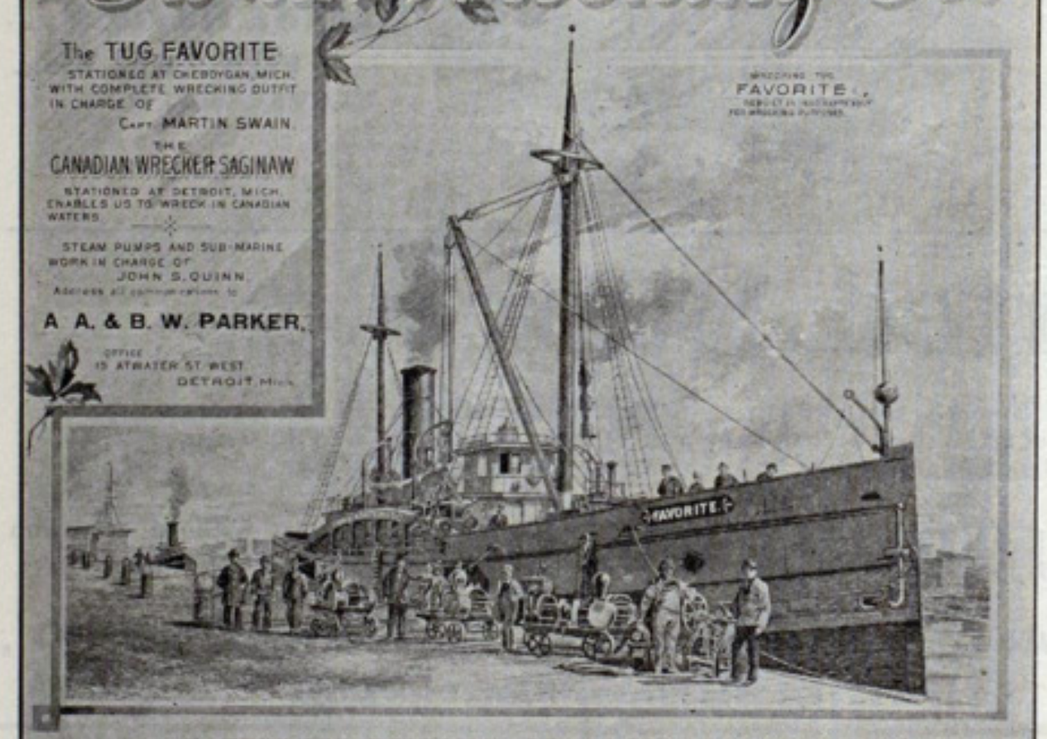
THE
Swain Wrecking Co.



4 STEAM PUMPS, 10 JACKS, 3 HAWSERS.

1 COAL and ORE PUMP
3-12 INCH ROTARY.
1-14 INCH WORTHINGTON.

DIVING RIGS AND DIVERS ABOARD AT ALL TIMES

SEPTEMBER.						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	...	...	...	...	..
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10-100 TON JACKS
1-12 INCH HAWSER
1-10
1-9

Telegraph
CAPT. M. SWAIN,
CHEBOYGAN, MICH.

TELEGRAPH.

A. A. & B. W. PARKER, SUCCESSORS TO PARKER & MILLEN,
DETROIT, MICH.

Pickands, Mather & Co.,

FUEL LIGHTERS AT BUFFALO, ERIE, ASHTABULA AND CLEVELAND.

AT DETOUR, MICH., A FUEL DOCK equipped with Shute capacity of 600 Tons.

Best Quality PITTSBURGH COAL furnished at any time during Day or Night.

Western Reserve Building, CLEVELAND, O.

American Newspaper Directory.

Tells the circulations of all American newspapers. Revised, corrected and reissued every three months. Sixteen hundred pages: Price Five Dollars a volume or $20 a year.

BUFFALO.

We should hardly know how to get along without the American Newspaper Directory. We regard it by all odds the most complete and reliable guide that the advertiser can make use of; in fact, we use no other.

Buffalo, N. Y., July 24, 1901.
R. V. Pierce, M. D.,
President World's Dis. Med. Ass'n.

VERMONT.

The American Newspaper Directory stands, as it has always stood, the first and best of newspaper directories—the only one which cannot be ignored, the only one which every advertiser must have. No other can take its place; no other is needed—Joseph Auld, in the Burlington (Vt.) News of July 3, 1896.

ADVISOR.

The Advisor accepts the American Newspaper Directory as the standard in newspaper ratings. The obstacles which obstruct its efforts to get true and reliable information are many.

* * * *

The directory question is one which interests every publisher in the country—nay, the entire world. But in the United States directories are becoming altogether too numerous. In this, as with other books of reference, it is necessary to have one which may be relied on as being an authority on the matter of newspaper circulations. There can be no question about the fact that at this time, as for many years past, the American Newspaper Directory is that authority. The Advisor is not paid to make this announcement. It makes the statement in the interests of advertisers and publishers because it is true. One thing the advertiser is almost cock-sure of when he refers to the American Newspaper Directory is that the circulation figures he sees therein are not overstated to any great extent. In most other directories they are. Only the publisher himself is to be blamed for not securing a proper rating in that publication, and every advertiser of consequence knows it. Thus the publisher who refuses to furnish a statement places himself under a reasonable suspicion.—The Advisor for June.

New York, June, 1901.

CHICAGO.

Messrs. Geo. P. Rowell & Co.'s American Newspaper Directory has long since earned the reputation of being the best of its character. It contains the results of patient, expensive and systematic effort to secure all attainable information of interest concerning American newspapers. The work has been honestly done. This will not be questioned by any unprejudiced examiner. The most important question is circulation. In attempting to give this information the editor of the Directory encounters his most difficult work. It is the aim and necessity of the Directory to give the truth. The American Newspaper Directory is to-day the dependence and guide, in a greater or less degree, of every large advertiser in the country.—Chicago (Ill.) Daily News.

BATES.

The American Newspaper Directory is the only reliable guide for the advertiser.

No man who advertises can afford to do without it.

What Bradstreet and Dun are to the mercantile world the American Newspaper Directory is to the world of periodical publications.

A new advertiser will get from the American Newspaper Directory a better idea of the greatness of his country, and the tremendous possibilities in newspaper advertising, than from any other source.

If an advertiser spends only $100 a year he should have the American Newspaper Directory. For his business may grow and his right expenditure of his money become increasingly important. The time to learn how to spend $10,000 is before it is spent, otherwise the spending may be disastrous.

Many times the best paper in town costs the advertiser no more than the poorest. The American Newspaper Directory tells which is which.

The paper that was the leader in its town five years ago may lag behind today. Even one year may witness astonishing changes. If you are spending money for publicity it is vastly important that you should know where to get the most of it for the price. The American Newspaper Directory gives not only the present circulation rating of every paper in America, but shows their history by quoting past ratings.

The book costs five dollars a copy, and a single reference to it may readily save or make many times its cost.

All newspaper directories but one are erroneously optimistic about circulations. The American Newspaper Directory may occasionally err on the other side, but that makes it all the safer for the advertiser.

My advertising experience began in 1885, and one of the first things I did was to buy a copy of the American Newspaper Directory.

For sixteen years Rowell's "The American Newspaper Directory" has had a place of honor and usefulness on my desk.

Many a publisher is ready to prove by other directories that "Rowell's is wrong," but few indeed can be induced to prove it by opening their circulation books to the advertiser.

Among publishers who are not willing that their real circulations be known it is the best hated book in print. The moral is not far to find.

Charles Austin Bates.
New York, June 24, 1901.

PABST.

If the improvement of the American Newspaper Directory continues in the future as it has during the past twenty years I do not think I shall live long enough to see any other directory take its place. There will, however, be the usual crop of directories, just as every other good thing is imitated. Your long years of experience in dealing with evasive circulation reports have most admirably fitted you for placing a proper valuation upon such statements. Advertisers have come to know that the Rowell estimates are nearer the proper figure than can otherwise be obtained. The American Newspaper Directory is therefore indispensable in every well regulated advertising department. Lines are being more tightly drawn every day; it is difficult to collect for twenty thousand when you print only eight. If the advertiser were buying barley he would not accept three pecks for a bushel, although the quality might at all times be open for discussion.

The American Newspaper Directory is the guide and companion of the advertising man, and it is to the interests of all concerned to help perfect it, support it and hurrah for it.

Pabst Brewing Co.,
J. R. Kathrens, Adv. Mgr.
Milwaukee, Wis., June 7, 1901.

SAPOLIO.

A growing need created it—the advertising agency system. One of the earliest and most successful workers, Geo. P. Rowell, is still in the field. He originated methods. Others followed. A first early step in advance was his publication of a list of all the papers—the American Newspaper Directory. He has never ceased to love it, and labor for it. Soon, out of the gross stupidity of imitation, it became a rule that every agency down to those of Oshkosh or Oklahoma must issue its own directory. An awful waste, for not more than one out of ten was worth shelf room. If the National Association of Advertising Agents could agree long enough to buy Mr. Rowell's Directory, publish it officially and drop all the others, it would accomplish something.

Artemas Ward,
Advertising Manager for Sapolio.
—In Fame, March, 1901.

WASHINGTON.

Every page of the American Newspaper Directory breathes the desire of its publishers that it shall be absolutely correct in every statement it makes.

Truly yours, Frank Roe Batcheld,
Clerk of the Committee on Banking and Currency, House of Representatives, U. S.
Washington, D. C., Jan. 17, 1899.

SOUTHERN.

We subscribe to and pay cash for the American Newspaper Directory, and find it of great value in our advertising department. We have 6,892 miles of railway, extending from Washington, D. C., all over the South, and in advertising this system we use more than 1,000 publications, and in selecting this list we find that we get a correct idea of circulation from this Directory that can not be obtained from any other similar publication. We receive other newspaper directories gratis; but the fact that we pay cash for this one in addition shows that we can not place the same dependence upon the "free list."

We thoroughly appreciate the careful manner in which this Directory is compiled.

Washington, D. C., Sept. 13, 1900.
Jos. H. Hannen,
Adv. Dept. Southern Railway.

I am looking forward to receiving the new edition with a great deal of anticipation as, although the American Newspaper Directory seemed to have reached a high state of perfection several years ago, there is always something new and of value in each succeeding edition. It is regarded as the standard authority with the Southern Railway.

S. H. Hardwick,
General Passenger Agent.
Washington, D. C., May 21, 1901.

BALTIMORE.

We have used the American Newspaper Directory for many years and find it more valuable to us than any other similar publication. Much of the information given we cannot obtain in any other way. The book is not only a great help but a necessity to our business, and we think its way of stating circulations is the ideal one. A. C. Meyer & Co.,
Prop'rs of Dr. Bull's Cough Syrup, etc.
Baltimore, July 31, 1901.

Five Dollars a Volume or $20 per annum. Sent, carriage paid, on receipt of price. Address

GEORGE P. ROWELL & CO., Publishers American Newspaper Directory, **10 Spruce St., New York.**

CASTNER, CURRAN & BULLITT,

SOLE AGENTS FOR

POCAHONTAS SMOKELESS SEMI-BITUMINOUS COAL

THE BEST STEAM COAL IN THE WORLD.

Officially endorsed by Great Britain and United States. Standard Fuel of United States Navy.
Used exclusively on Cunard, White Star and other Transatlantic Lines.

Main Office, 328 Chestnut Street - - PHILADELPHIA PA.

BRANCH OFFICES:

1 Broadway, New York. Old Colony Building, Chicago, Ills. Terry Building, Roanoke, Virginia.
Citizens Bank Building, Norfolk, Va. 70 Kilby Street, Boston, Mass. Neave Building, Cincinnati, Ohio.
Calle Reconquista 399, Buenos Ayres, Argentine Republic, South America. 4 Fenchurch Avenue, London, England.

PITTSBURG COAL CO.

Steamboat Fueling Facilities at various points on the Great Lakes:

Cleveland Harbor	4 Car Dumpers. 3 Lighters.	Fairport Harbor	1 Car Dumper. 1 Lighter.	Ashtabula Harbor	1 Car Dumper. 1 Lighter.	Erie Harbor	1 Car Dumper. Fuel Pockets.

Detroit River Branch	Docks and Pockets at Sandwich and Amherstburg.	Sault River Branches	Dock and Pockets at Detour. Dock and Pockets at Sault Ste. Marie. (The Port Royal Dock Co.)

WE FURNISH ONLY THE BEST GRADE OF **PITTSBURG and YOUGHIOGHENY COAL.**

General Office, Lake Department, Perry-Payne Building, Cleveland, O.

STEAMBOAT FUEL AT CHICAGO.

THE Y&L

Youghiogheny and Lehigh Coal Co.

J. T. CONNERY, Manager. ARCHIE J. HITCHCOCK, Dock Sup't.

FUEL DOCKS: No. 1, Michigan Slip & Basin. 'Phone Main 1650.
No. 2, N. Halsted St. Bridge. 'Phone Main 1649.
No. 3, Foot South Water St. and Illinois Central Slip C. 'Phone Main 1679.

FUEL LIGHTER: Equipped with 125 2-ton Buckets for Fueling Anywhere in Harbor.

MAIN OFFICE: 1238-1242 Chicago Stock Exchange Building.

Long Distance Telephone, Main 1650. 110 LA SALLE STREET.

The Rochester & Pittsburgh Coal & Iron Co.

REYNOLDSVILLE COAL.

STEAMBOAT FUEL DOCK—Blackwell Canal at Michigan St. Bridge. 1400 feet of dock frontage. Hulett Car Dumping Machine. Steam Fuel Scow of 550 tons capacity. Boats coaled day or night.

OFFICE: 684-88 Ellicott Square, BUFFALO, N. Y.
TELEPHONE, Seneca 1154.

E. McQ. DUTHIE, Cargo and Fuel Agent.

STANLEY B. SMITH & CO.

DETROIT, MICH.

SHIPPERS OF **COAL** BY RAIL AND LAKE

OPERATING

SMITH'S COAL DOCK, Detroit River.

A COMPLETE SET OF CHARTS OF THE GREAT LAKES

LAKE SUPERIOR.	DETROIT RIVER.
LAKE MICHIGAN.	ST. CLAIR RIVER.
LAKE HURON.	LAKE ST. CLAIR.
LAKE ERIE.	STRAITS OF MACKINAC.

ST. MARY'S RIVER IN THREE PARTS.

ELEVEN IN ALL

SENT TO ANY ADDRESS, CARRIAGE PREPAID, FOR

$5.45.

THE MARINE REVIEW PUB. CO., 418-419 Perry-Payne Building, CLEVELAND, O.

VESSEL AND INSURANCE AGENTS.

C. W. ELPHICKE & CO.
Vessel and Insurance Agents,

C. W. ELPHICKE.
CALVIN CARR.
H. B. EARHART.
R. J. DUNHAM.

Room 10, No. 6 Sherman St.,
CHICAGO, ILL.
Long Distance Telephone, Harrison 1194.

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JOHN MITCHELL.
JOHN F. WEDOW.
ALFRED MITCHELL.

Vessel and Insurance Agents,

Office Telephone M 767.
508, 509 & 510 Perry-Payne Bldg.
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John F. Wedow, Doan 141 J. Alfred Mitchell, Doan 218.

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12 Sherman Street,
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Board of Trade,
DULUTH, MINN.

W. C. RICHARDSON,
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Office Telephone 338.
Residence Telephone 2938. CLEVELAND, O.

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Vessel Agents,

M. M. DRAKE.
G. W. MAYTHAM.
202 Main Street,
Telephone Seneca 1660. BUFFALO, N. Y.

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Wood & Co., R. D.....Philadelphia.

CRANK PINS.

Cleveland City Forge & Iron Co.....Cleveland.

DIVING APPARATUS.

Hale Rubber Co., Alfred.....So. Boston, Mass.
Schrader's Son, A.....New York.

DRILL PRESSES—DRILLS OF ALL KINDS.

Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

DRILLS, PNEUMATIC.

Standard Pneumatic Tool Co.....Chicago.

DRYING APPARATUS.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Sturtevant, B. F. Co.....Boston.

DRY DOCKS.

American Ship Building Co.....Cleveland.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Harlan & Hollingsworth Co.....Wilmington, Del.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Shipowners Dry Dock Co.....Chicago.

ELECTRIC LIGHT AND POWER PLANTS.

Badt-Goltz Engineering Co.....Chicago.
Buffalo Forge Co.....Buffalo.
Electro-Dynamic Co.....Philadelphia.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Seidler-Miner Electric Co.....Detroit.
Sturtevant, B. F. Co.....Boston.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC HOISTS AND CRANES.

Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Lidgerwood Mnfg. Co.....New York.
Westinghouse Electric & Mnfg. Co.....Pittsburg, Pa.

ELECTRIC STEERING GEAR, SPEED AND RUDDER INDICATORS, ETC.

Electro-Dynamic Co.....Philadelphia.

ENGINE BUILDERS, MARINE.

American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Craig Ship Building Co.....Toledo, O.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Ship & Engine Co.....Quincy, Mass.
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated.....New York.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lake Shore Engine Works.....Marquette, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Olds Motor Works.....Detroit.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Willard, Chas. P. & Co.....Chicago.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.

Cory, Chas. & Son.....New York.
Electro-Dynamic Co.....Philadelphia.
Seidler-Miner Electric Co.....Detroit.

ENGINEERING SPECIALTIES AND SUPPLIES.

Crane Co.....Chicago.
Reilly Repair & Supply Co., James.....New York.

ENGINEERS, MARINE AND MECHANICAL.

Electro-Dynamic Co.....Philadelphia.
Gaskin, Edward.....Buffalo.
Hunt, Robt. W. & Co.....Chicago.
Miller, Walter.....Cleveland.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.
Powell, Ambrose V.....Chicago.
See, Horace.....New York.
Wood, W. J.....Chicago.

EVAPORATING AND DISTILLING APPARATUS.

Reilly Repair & Supply Co., James.....New York.

FANS FOR VENTILATION, EXHAUST, ETC.

American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FEED WATER PURIFIERS AND HEATERS.

Learmonth, Robert.....Buffalo.
Reilly Repair & Supply Co., James.....New York.
Reynolds, H. J.....Cleveland.
Smith, W. Blackburn.....Perth Amboy, N. J.

FIRE EXTINGUISHING APPARATUS.

Clayton Fire Extinguishing & Disinfecting Co.New York.

FIXTURES FOR LAMPS, OIL AND ELECTRIC.

Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

FOG SIGNALS.

Colt Co., J. B.....New York.
Hamilton-Foster Fog Signal Co.....New York.

FORGES.

Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.

Cleveland City Forge & Iron Co.....Cleveland.
Fore River Ship & Engine Co.....Quincy, Mass.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

FUELING COMPANIES AND COAL DEALERS.
Castner, Curran & Bullitt (Pocahontas).....Philadelphia.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Rochester & Pittsburgh Coal & Iron Co.....Buffalo.
Scott Co., The W. L.....Erie, Pa.
Smith, Stanley B. & Co.....Detroit.
Youghiogheny & Lehigh Coal Co.....Chicago.

GAS BUOYS.
Safety Car Heating & Lighting Co.....New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.
Lake Shore Engine Works.....Marquette, Mich.
Olds Motor Works.....Detroit.

GAGES, STEAM AND VACUUM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

GRAPHITE.
Dixon Crucible Co., Joseph.....Jersey City, N. J.

GRAPHITE BUSHINGS AND BEARINGS.
Graphite Lubricating Co.....Bound Brook, N. J.

HAMMERS, PNEUMATIC.
Standard Pneumatic Tool Co.....Chicago.

HAMMERS, STEAM.
Bement, Miles & Co.....Philadelphia.
Chase Machine Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.

HATCH GEARS.
"Long Arm" System Co.....Cleveland.

HAWSERS, WIRE.
American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant, B. F. Co.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co., Incorporated..Cleveland.
Chase Machine Co.....Cleveland.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
Marine Iron Co.....Bay City.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

HOSE FOR PNEUMATIC TOOLS.
Sayen & Schultz.....Philadelphia.

HYDRAULIC MACHINERY.
Bement, Miles & Co.....Philadelphia.
Watson-Stillman Co., The.....New York.
Wood & Co., R. D.....Philadelphia.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

IGNITERS FOR GAS ENGINES.
Holtzer-Cabot Electric Co.....Brookline, Mass.

INJECTORS.
Crane Co.....Chicago.
Jenkins Bros.....New York.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Tandy, Frank N.....Boston.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

LAUNCHES—NAPHTHA, ELECTRIC.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

LOGS.
Walker & Son, Thomas.....Birmingham, Eng.
Also Ship Chandlers.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MACHINE TOOLS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

MALLETS FOR CAULKERS, BOILER MAKERS, ETC.
N. Y. Mallet & Handle Works.....New York.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.
Lein, Irvine & Co.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Boston Blower Co.....Hyde Park, Mass.
Bloomsburg & Co., H.....Newport News, Va.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.
Paul & Co., J. C.....Chicago.

MILLING MACHINES OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Gaskin, Edward.....Buffalo.
See, Horace.....New York.
Wood, W. J.....Chicago.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Crane Co.....Chicago.
Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Sayen & Schultz.....Philadelphia.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Toch Bros.....New York.
Upson-Walton Co.....Cleveland.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PIPE THREADING AND CUTTING MACHINES.
Merrell Mnfg. Co.....Toledo, O.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.
Crane Co.....Chicago.

PLANERS OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PLATE BENDING AND PLANING MACHINES.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

PLUMBING, MARINE.
Reilly Repair & Supply Co., James.....New York.
Sands, Alfred B. & Son.....New York.

PNEUMATIC TOOLS.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.
Paul & Co., J. C.....Chicago.

PRESSURE REGULATORS.
D'Este Co., Julian.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.
Badt-Goltz Engineering Co.....Chicago.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Kingsford Foundry & Machine Works.....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

R. I. W. DAMP RESISTING PAINT.
Toch Bros.....New York.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER GOODS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SEAM COMPOSITION AND ELASTIC SEAM PAINT.
Cole & Kuhls.....Brooklyn.

SEARCH LIGHTS.
Badt-Goltz Engineering Co.....Chicago.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Trigg, Wm. R. Co.....Richmond, Va.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Moran Bros. Co.....Seattle, Wash.
Reilly Repair & Supply Co., James.....New York.
Upson-Walton Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.
Algoma Central Co.....Sault Ste. Marie, Ont.
American Line.....New York.
Cleveland & Buffalo Transit Co.....Cleveland.
Dominion Line .....Boston.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL CASTINGS.
Seaboard Steel Casting Co.....Chester, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

SUBMARINE DIVING APPARATUS.
Hale Rubber Co., Alfred.....So. Boston, Mass.
Schrader's Son, A.....New York.

SURVEYORS, MARINE.
Gaskin, Edward .....Buffalo.
See, Horace.....New York.
Wood, W. J.....Chicago.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.
Standard Pneumatic Tool Co.....Chicago.
Watson-Stillman Co.....New York.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Atlantic Works, Inc.....Philadelphia.

TOPOPHONE—Prevents disasters in fogs.
Colt Co. J. B.....New York.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

TRAPS, STEAM.
D'Este Co., Julian.....Boston.
Haines Co., Wm. S.....Philadelphia.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.
Benedict & Burnham Mnfg. Co.....Waterbury, Conn.
Standard Seamless Tube Co.....Pittsburg.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crane Co.....Chicago.
Crosby Steam Gage & Valve Co.....Boston.
D'Este Co., Julian.....Boston.
Jenkins Bros.....New York.
Wood & Co., R. D.....Philadelphia.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Hall & Root.....Buffalo.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Kennedy Hunter & Co.....Antwerp.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Tandy, Frank N.....Boston.

VENTILATING APPARATUS FOR SHIPS.
American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

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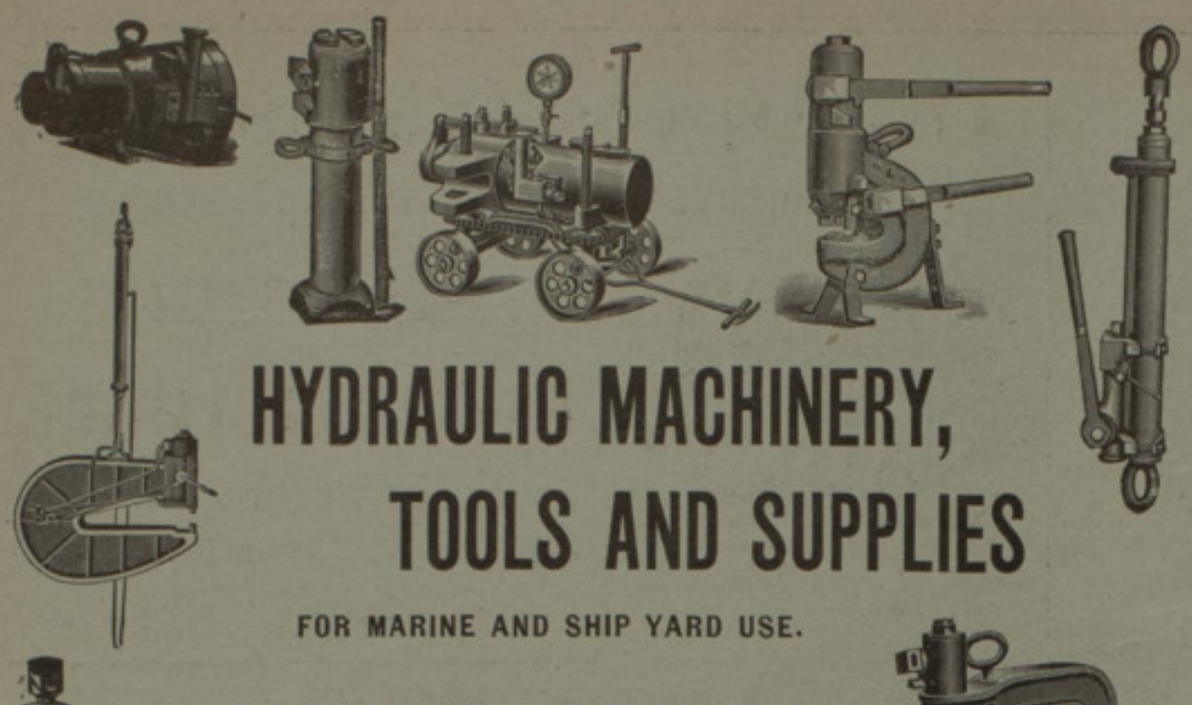

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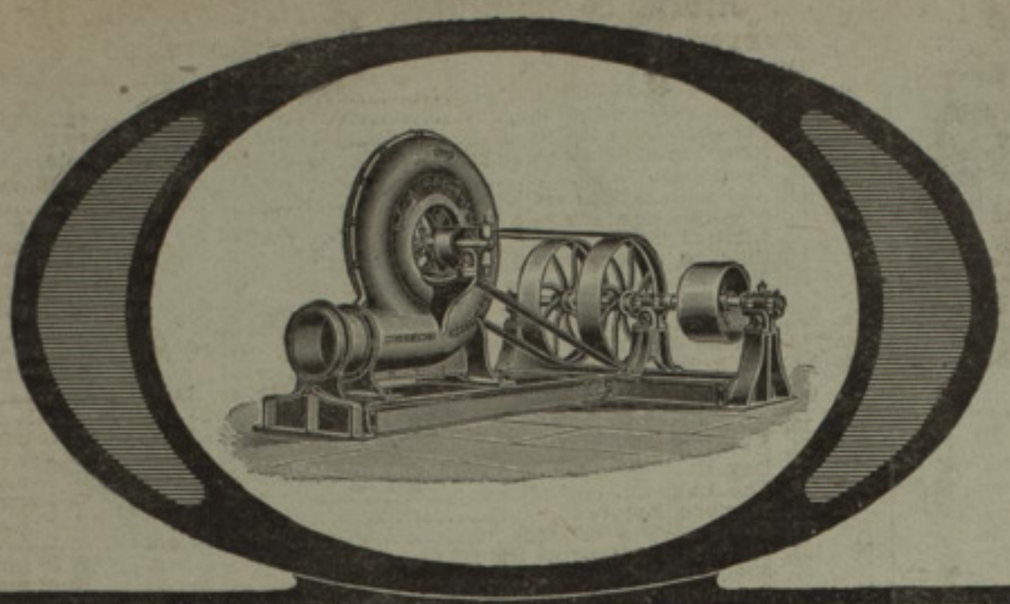

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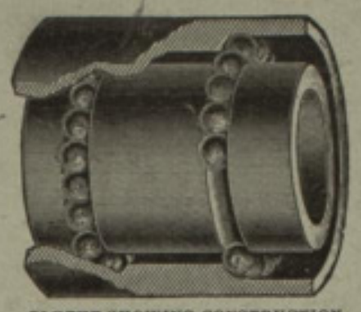

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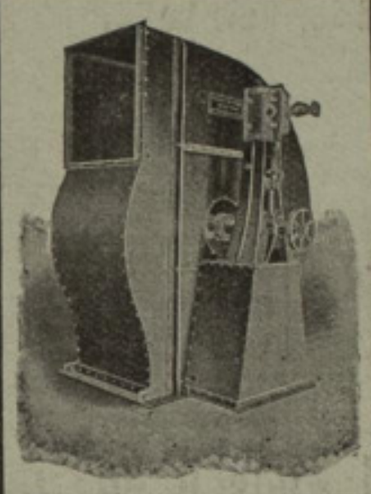

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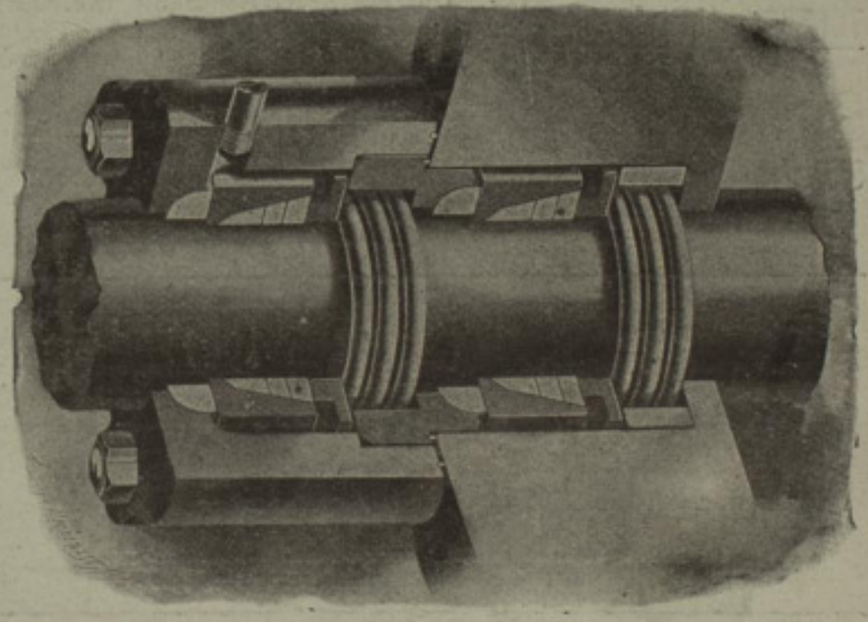

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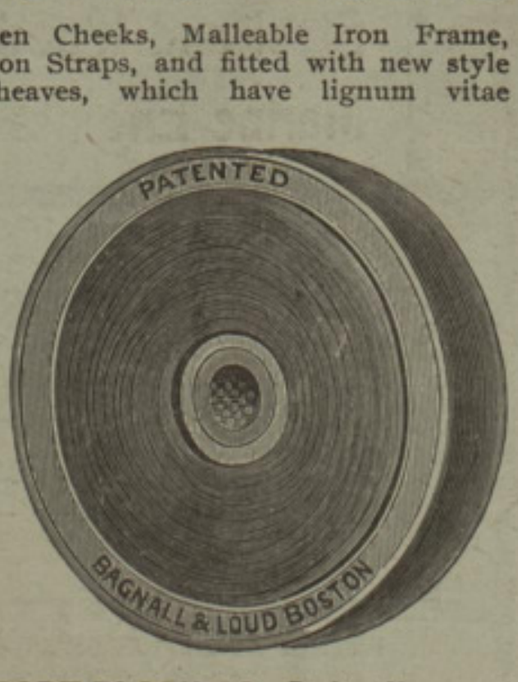

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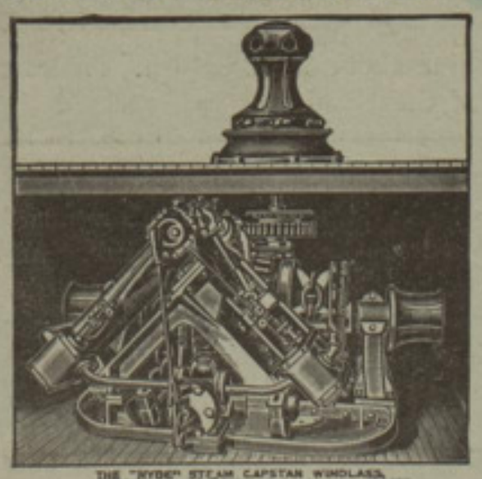

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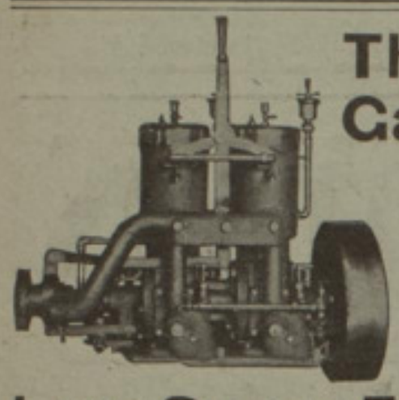

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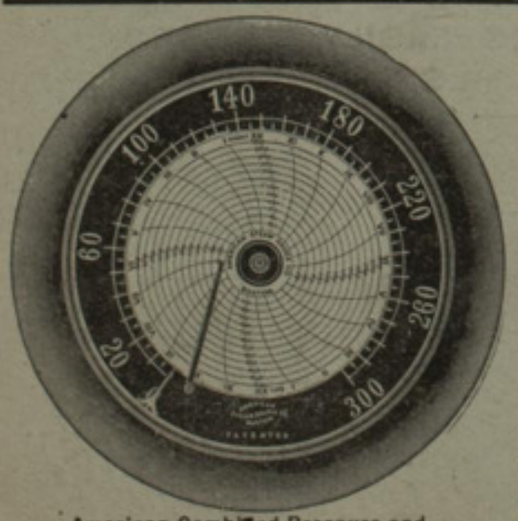

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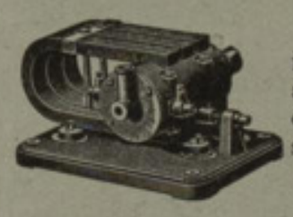

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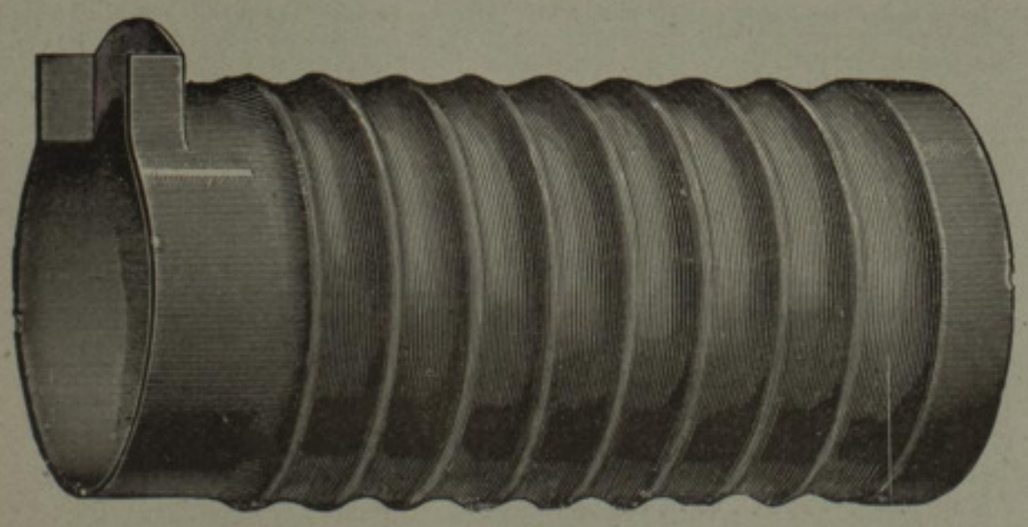

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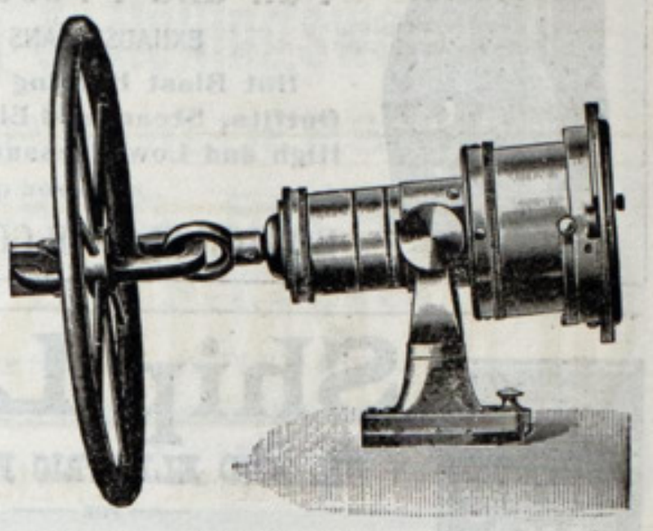

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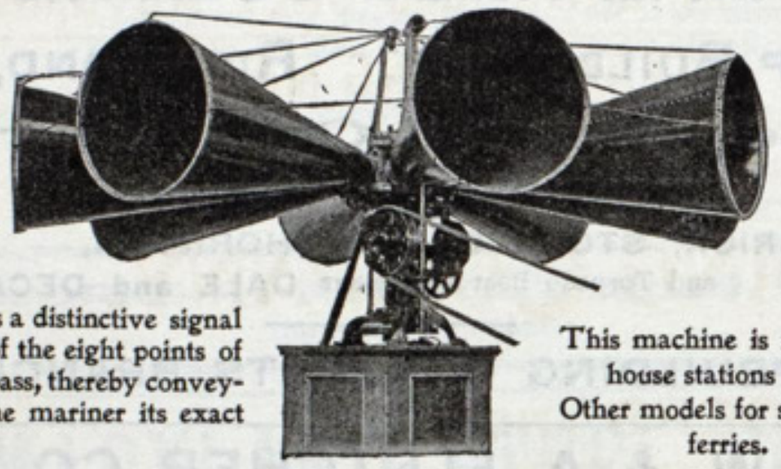

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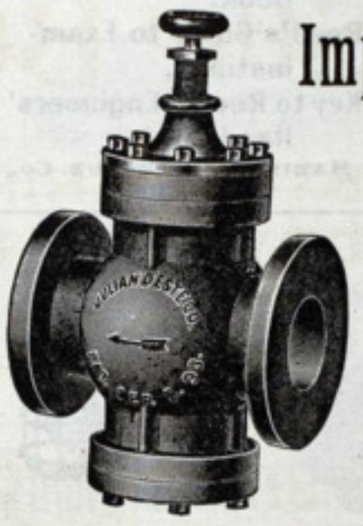

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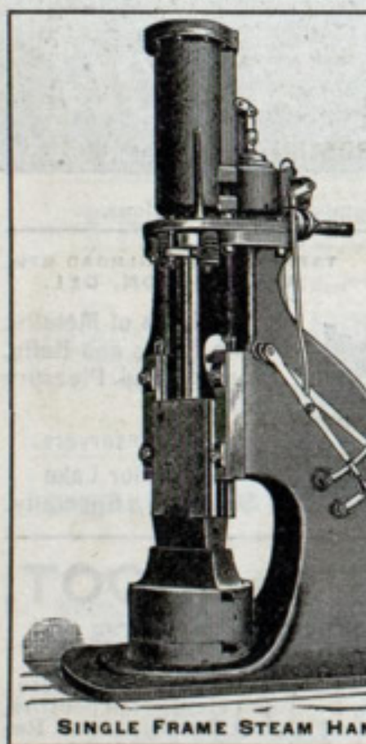

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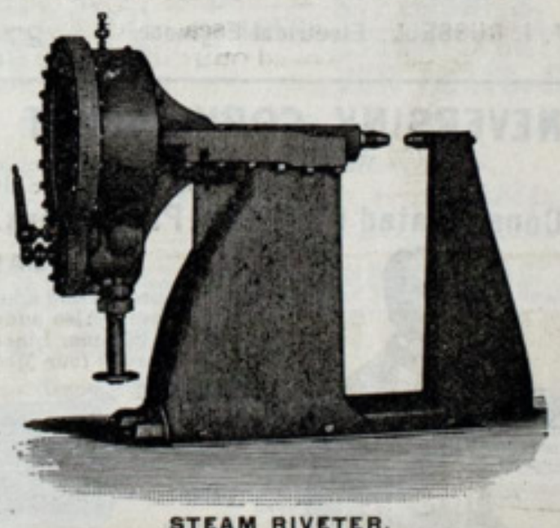

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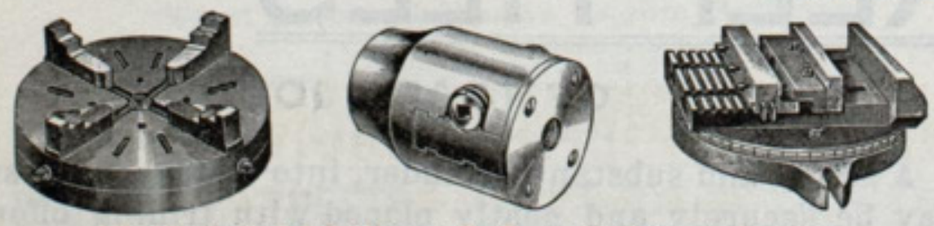

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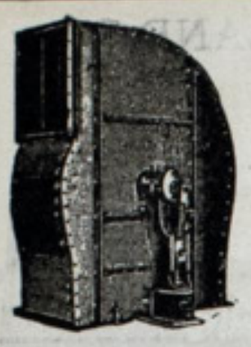

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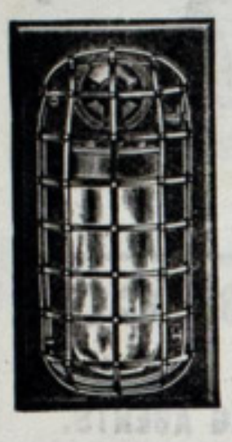

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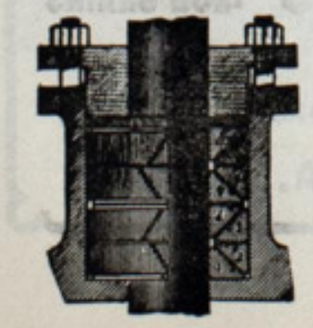

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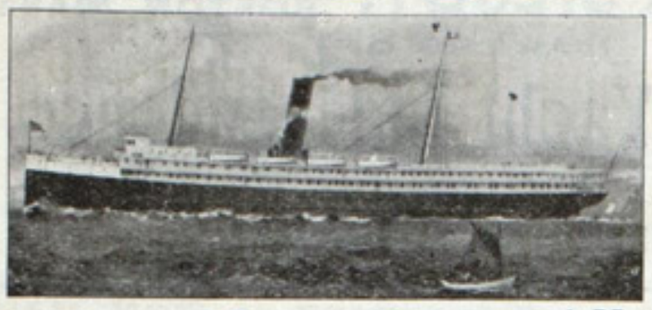

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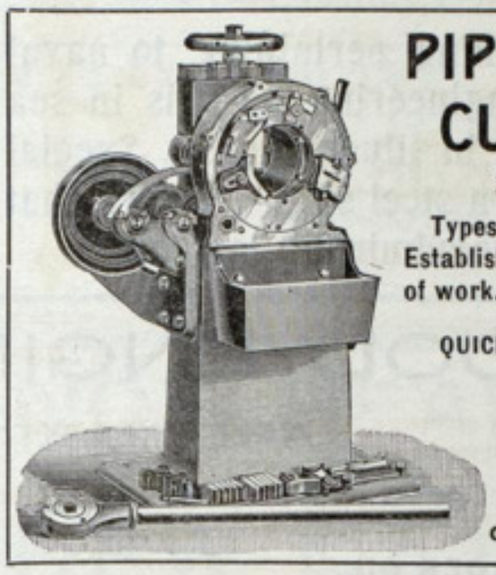

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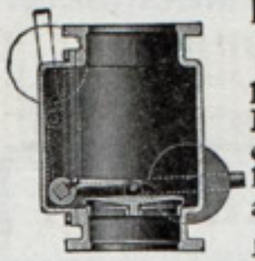

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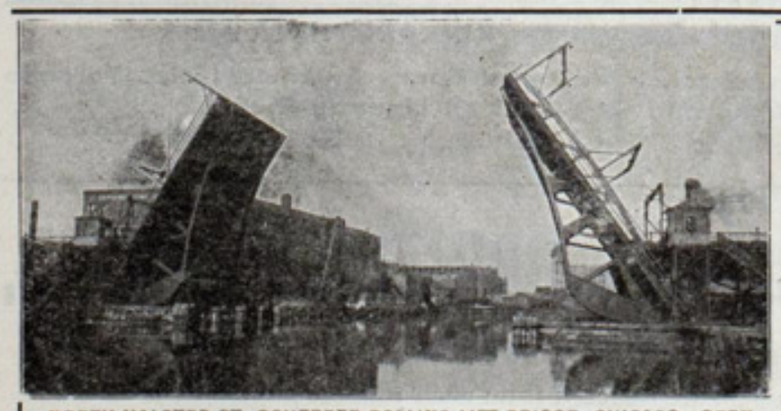

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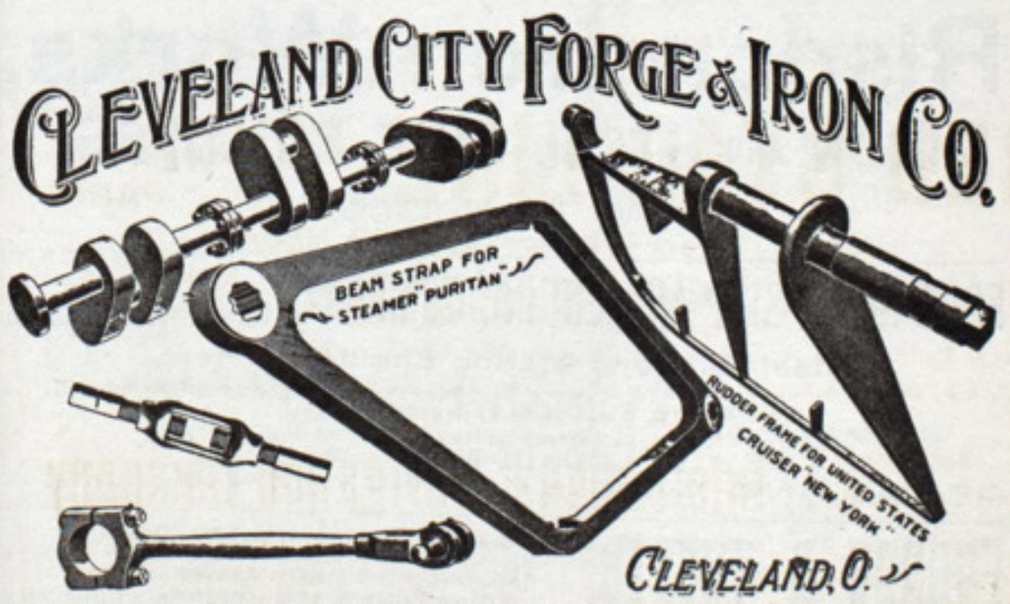

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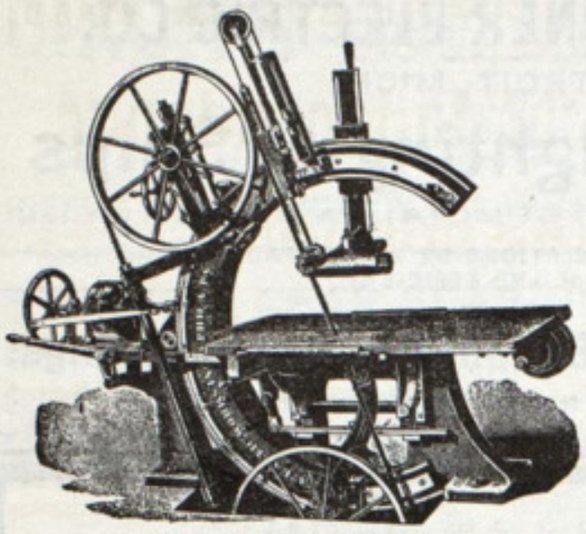

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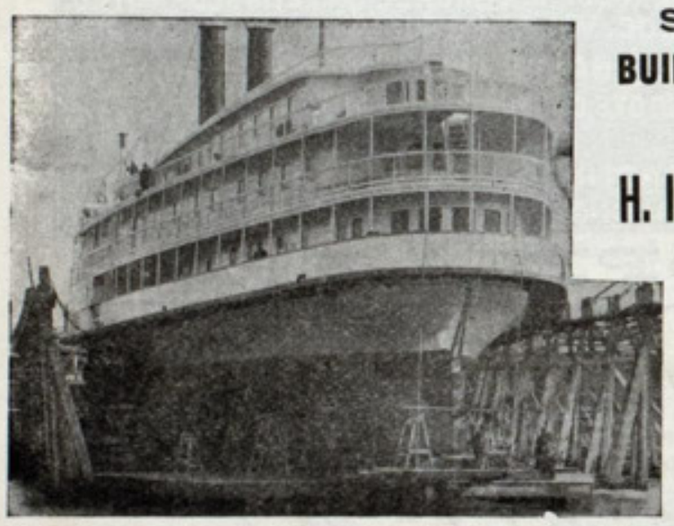

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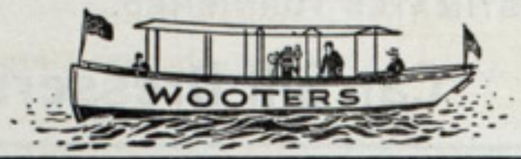

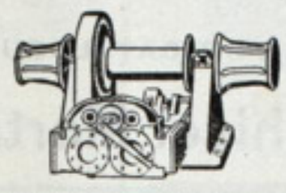

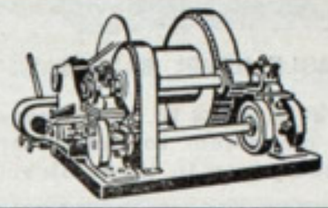

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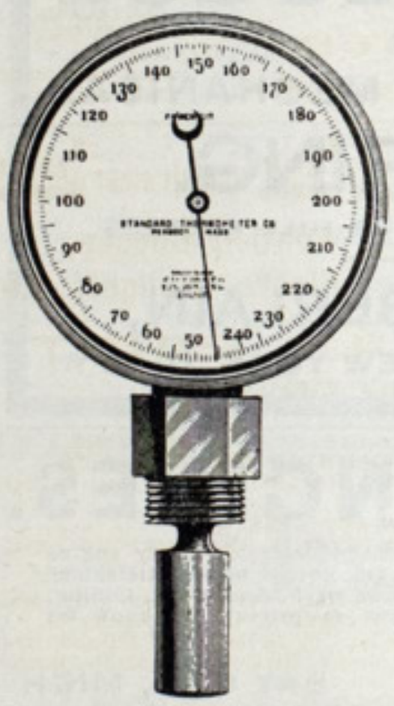

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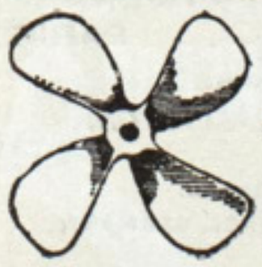

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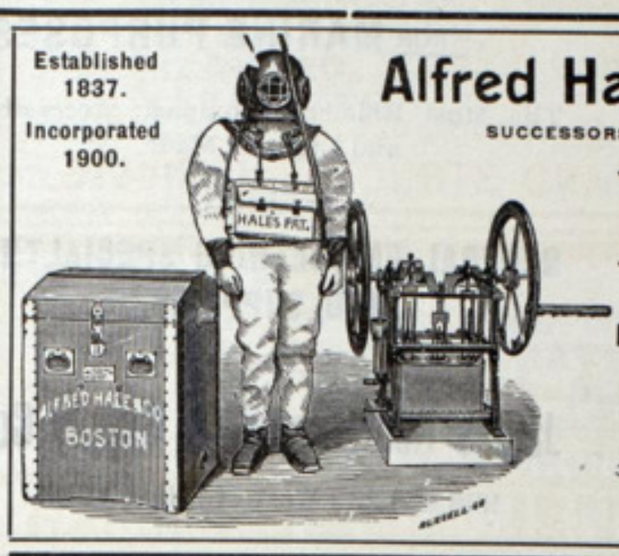

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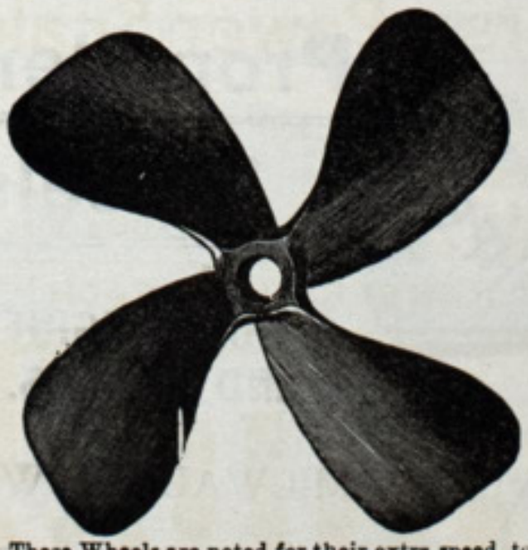

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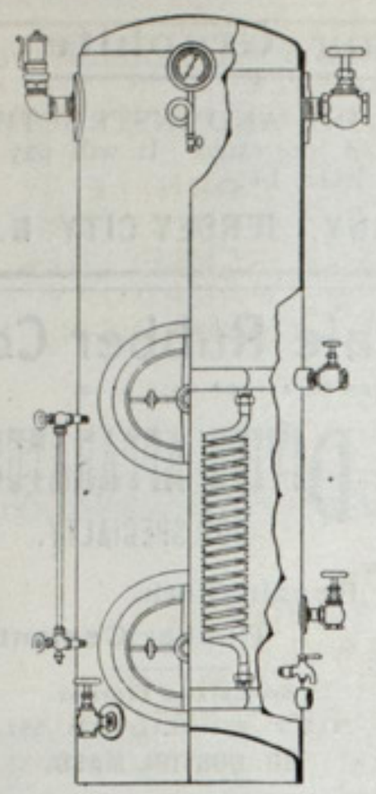

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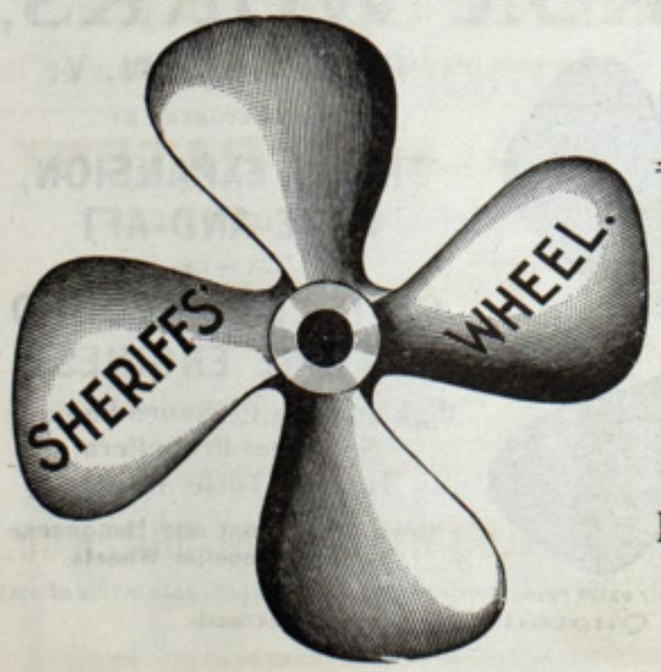

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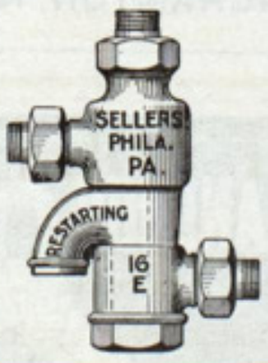

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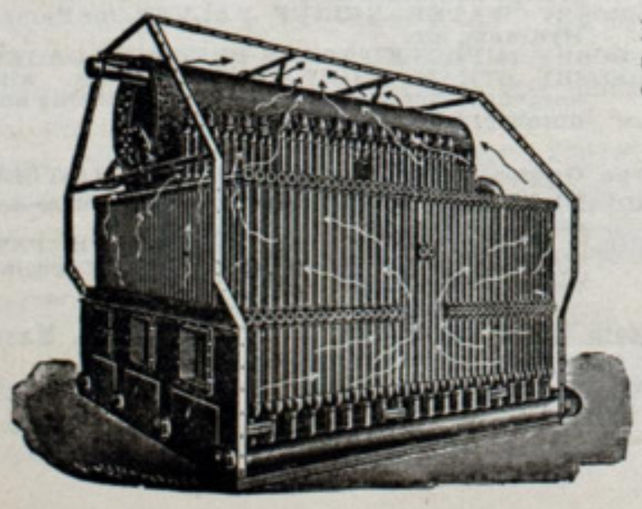

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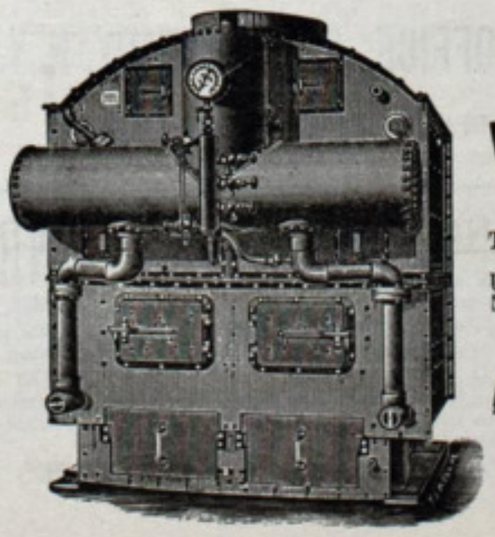

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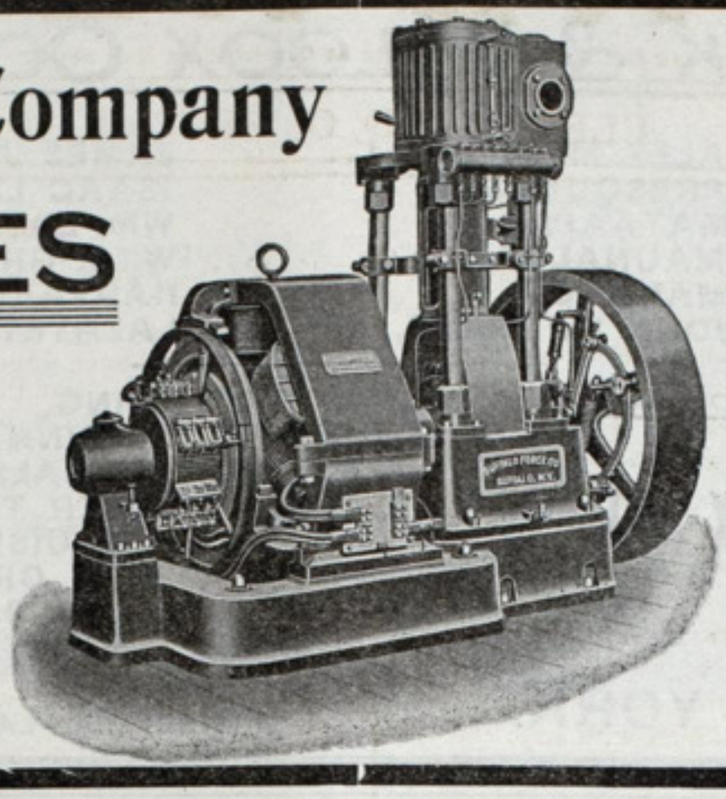

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